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Fig. 1.—Rock Tunnel Finished, Plastered and Partly Filled With Conduit.

Chicago's Tunnels for Electric Light and Power Cables

Details of Commonwealth Edison Co.'s Tunnels—Construction Methods Employed—Relative Advantages of Tunnels and Conduit

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IN CHICAGO the river divides the city into three parts and as the economical transmission of electric current under various streets requires direct routes, the building of a number of tunnels under the river at certain intervals has been necessary.

Thirteen tunnels for this purpose have been built to date and all are of a standard size, 6 ft. 6 in. high and 6 ft. wide, the top half being semi-circular, with vertical sides from the springing line to the bottom. A slant of about 2 in. is given to the floor toward the center and a 3-in. trough provided to take drainage to the sump at the shaft. The section indicated was found to be the most practical and economical for the purpose, as it permits ducts to be installed with minimum loss of space.

On account of the changeable character of the underlying material of the city, such as soft clay, hard blue clay, quicksand, hard pan and gravelly water-bearing strata, many interesting and difficult problems naturally arise which it will be the purpose of this article to describe.

In some tunnels a stratum of good blue clay was found deep enough to be under foundation piles of bridges and still sufficiently distant from bed rock to escape the gravelly material which overlays the rock and which if penetrated causes much trouble from

water. It is most desirable to build a tunnel in clay both from the standpoint of obtaining a dry tunnel and also from the economical point of view.

In general, it is the policy to have the roof of the tunnel about 50 ft. below datum and about 12 to 15 ft. of good ground is required between the top of the tunnel and the river bed. In cases where these conditions cannot be met, it is necessary to build the tunnel in rock, which involves more expense and greater difficulties, as rock usually has many seams or fissures which admit water under pressure to the drifts.

Fig. 2.—Form of Inclined Derrick Used for Rock Tunnel.

In order to ascertain the conditions at the sites of the shafts, borings are made to bed rock and the character of the material noted. While borings are not always reliable, much valuable information can be gained in advance by making the plans, and in most cases it is found that borings pay. Some exceptions are made as, for example, at a point where a tunnel or foundation has been built and a reliable record is accessible or if previous borings have been made within a reasonable distance and the general level of the rock from the government geological reports appears to be about the same. These reports, which are borne out by experience, show rock about 95 to 100 ft. below datum in the downtown district, gradually sloping upward for about three miles west and northwest, while about two miles southwest rock crops out on the surface.

Fig. 3.—Derrick Over Tunnel Shaft, Showing Method of Handling Material.

Constructing the Tunnels.

The shafts are located with reference to the building line of the street so as not to be interfered with in case of deep foundations for buildings adjacent. A distance of 5 ft. is usually allowed for the outside of the shaft from building line. When the locations of the shafts and the approximate depth of the tunnel have been decided upon, excavation is started and usually about 4 ft. is excavated at a time. Steel rings, 3 by 3¾ in., are placed in position with 2-in. lagging backing them up. Two rings are used to each set of lagging, the rings being made in two halves to permit of lowering them and they are then securely bolted together.

When the material is not sufficiently stable to support the rings without distortion or where the material will not stand up it is necessary to build a timber shaft or use some other form of construction, as steel cylinders.

Timber shafts are built of 12 by 12-in. and 2-in. sheeting. Where quicksand is encountered, ⅜-in. steel shells or cylinders are sunk by loading them down with pig iron or other weights and bolting on the required number of cylinders, as they are sunk.

When the shaft excavation has reached the desired depth and the ground for the height required for the tunnel is found to be good clay or hard pan, it is usually deemed advisable to concrete the shaft before starting the tunnel as exposure of various materials to air causes disintegration and sometimes endangers the shaft. This work generally is done by three shifts, each working 8 hours, thus obtaining a continuous bond in the concrete. Beginning at the bottom, the placing of wooden drums about 4 ft. high and of a diameter which is less than the excavated shaft by twice the thickness of the wall, say about 2½ ft., leaves an annular space which is filled with concrete. The wooden lagging and iron rings may be removed as the work progresses and after about 48 hours the wooden drums can be taken out. About 25 to 30 ft. of concreting can be done in 24 hours. The mixture recommended is 1 part of portland cement, 3 parts of torpedo sand and 5 parts of ¾-in. crushed limestone. All cement is tested and quality is made to conform with requirements adopted by the American Society of Civil Engineers. Samples are taken at the dealer's warehouse 30 days before it is used, thus permitting of boiling 24-hour, 7-day and 28-day tests. As soon as more cement is set aside in the warehouse the samples are taken. Probably on a tunnel taking 4 months to build, the samples would be taken about 3 or 4 times. A reliable testing laboratory is employed to make these tests. Concrete may be lowered in barrels suspended from the shaft house by a steel cable and lowered by electric or steam hoist. It is sometimes found to be economical to install an elevation and thus permit cars to be pushed direct to the heading from the shaft on a narrow gage railroad.

The drifting in the tunnel begins as soon as the shaft is cleared out of debris and pumped dry if any water should exist.

In order to obtain proper alinement a fine fish line is dropped on each side of the shaft on line above and

a transit instrument set on line below in the drift, say 10 or 15 ft. from the shaft. Reversing, points are set ahead and the process continued as the work progresses. It has been found to be a good scheme to drive plugs upward in the clay at the crown of the arch, as these are more easily preserved than points set in the floor. Lines may be suspended from horseshoe nails in the plugs. If a curve is necessary a regular railroad curve is figured out and put in by tangent offsets of offsets from the long chord. A line of levels is transferred from a bench mark above and stakes set in the tunnel about 10 ft. apart. A gradient of about 1 in. per 100 ft. is allowed to drain water to a sump in one of the shafts.

Wooden or steel channel forms of the proper shape are set 12 in. away from the excavation and 2 in. lagging placed on the forms, allowing for a minimum of 12 in. of concrete. The forms are placed every 4 ft. and concrete put in 6-in. layers and tamped. All excessive excavation or holes beyond the regular 10 in. are filled in solid with concrete. Steel collapsible forms are used to good advantage in large tunnels of 15 to 25 ft. in diameter but in small tunnels the wooden forms are more convenient and less expensive.

Fig. 4.—Rock Blasted Out of Shaft for Rock Tunnel, Showing Timbering to Bed Rock.

About 12 to 16 ft. of tunnel can be excavated and concreted each 24 hours, working three shifts as in the shafts. One shift working 8 hours can concrete the tunnel excavated by two shifts of miners.

The shifts are 8 hours each, two shifts from 4 p. m. till 12 midnight till 8 a. m. doing the mining and a day shift from 8 a. m. doing the concreting of the tunnel, mined by the two night shifts. Each shift mines about 6 ft. in a 6 ft. by 6 ft. 6 in. tunnel and one shift concretes the 12 ft. each 24 hours.

The number of men in a well regulated organization for each mining gang is as follows: 1 foreman, 1 engineer, 4 miners, 3 muckers, 2 topmen, 1 team. The concreting gang is composed of the following: 1 foreman, 1 engineer, 4 miners, 3 muckers, 2 topmen, 1 plasterer, 4 laborers, 1 team, 1 carpenter, 1 blacksmith, 1 timekeeper.

For larger tunnels the number of miners, muckers, topmen and laborers would be about proportionate, that is, to say in a 12-ft. tunnel about twice the number of this class of labor could be used while one foreman, engineer, carpenter, timekeeper, blacksmith, etc., would probably be sufficient.

Machine mixing of concrete is the best method on this class of work as the mixture is far more uniform and the expense considerably less than hand mixing.

A very economical method of handling the concrete is to have the mixer placed near the top of the shaft so that when the charge is emptied it falls down a galvanized iron chute about a foot or more in

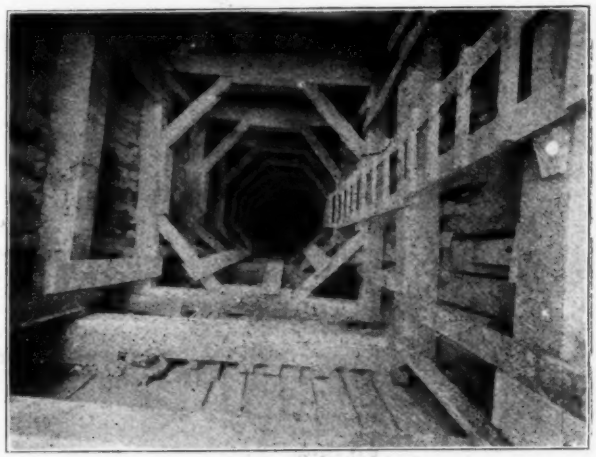

Fig. 5.—Timber Shaft for Rock Tunnel.

diameter into a car at the bottom heading in a very short time and can then be pushed to the proper location. The advantage of this gravity method is that it saves time loading on the car on top and lowering it in an elevator or by cable.

Experiences in Constructing Chicago Tunnels.

It may be of interest to mention some of the difficulties met in building these tunnels both in clay and rock.

In the east shaft of Washington street tunnel, built in 1903 in blue clay and hard pan, a stratum of quicksand at about 80 ft. below datum was encountered. This was 15 ft. in height and as it was impossible to excavate the material in the usual manner, an inner caisson of timber was built with an iron cutting edge. This was sunk by the weight of the concrete put in, leaving sufficient room to work inside and also by weighting it down with iron. At 96 ft. below datum, bed rock was reached, the quicksand was excavated and the space inside the caisson filled with concrete up to 72 ft. below datum where the tunnel

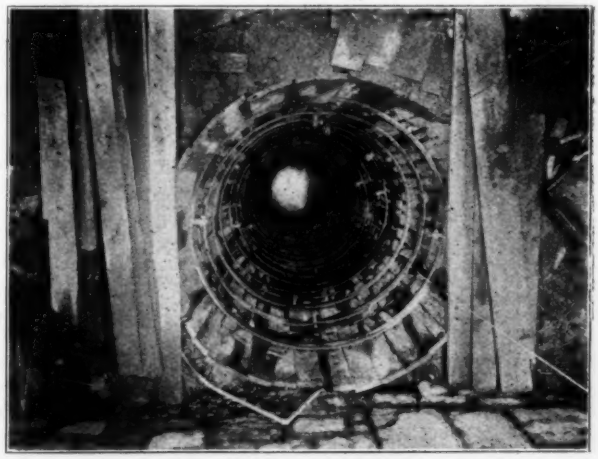

Fig. 6.—Shaft Excavated, Showing Steel Rings and Wooden Lagging to Prevent Bulging.

was drifted in good hard ground. No further trouble occurred.

A peculiar incident happened in this same tunnel about four years after its completion. The tunnel, which had always been very dry since it was finished, filled one night with water coming from fire engines

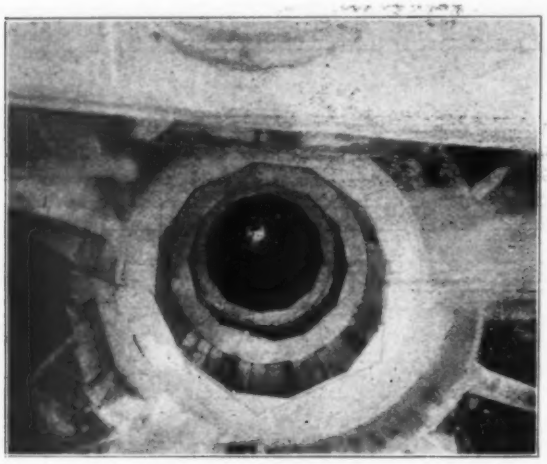

Fig. 7.—Concrete in Place Between Circular Wooden Drums and Wooden Lagging.

working on a burning building on the west side of the river which flowed into a manhole and down the west shaft. An attempt was made to pump out the shafts and tunnel with an electric pump but without success on account of lack of capacity. While arranging for a larger pump, it was noticed that the water had begun to recede, and in the course of two days the water had entirely disappeared. Where this water went to is still a mystery as the tunnel was built in the hardest kind of material which was blasted in places to loosen it up. One theory was advanced at the time—that the possibility of a defective casing in an artesian well in the vicinity may have permitted our water to be pumped out of the wall. At any rate, we were very much obliged to the innocent pumper if such was the case.

Another case of a tunnel becoming suddenly filled with water was at 22nd Street. During construction a pocket of quicksand was encountered about 50 ft. long near the arch of the tunnel and about 100 ft.

Fig. 8.—Steel Shell With Brick Lining Sunk Through Fifteen Feet of Quicksand.

from the west shaft. There had been no indication of bad material in either shaft or in the drift until this point was reached. Special precautions were taken and extra cement added to the concrete so that the tunnel when completed was apparently as dry as any we had built. Several months after completion, however, it filled during the night.

The electric pump could not keep ahead of the water so it was removed and the tunnel allowed to remain filled for two or three weeks. Experience had shown that in a leaky tunnel the process of pumping out the water for a few days and then leaving the tunnel filled with water for a week or two causes the clay to enter the interstices of the concrete and thus stops the leakage to a large extent. This gradual settling and drawing in of the clay back of the concrete wall enabled the tunnel to be pumped out in a few days.

An investigation showed about 10 or 12 small leaks from the size of a pinhead to ¼ in. The concrete was found to be sound and no cracks existed. The pump was kept working and in a few days the leaks slowed up. They were all cemented up and the water was allowed to come through in one or two ½-in. openings which were later plugged up. In about three weeks only a small amount of water entered and no difficulty was experienced in pumping the tunnel dry in a few hours.

As to the cause of the sudden filling of the tunnel it seems reasonable to suppose that the sinking of a caisson 12 ft. in diameter for a bridge foundation adjacent to the tunnel opened up the clay and thus admitted river pressure and the water found its way through the concrete wall where trouble with quicksand had previously been experienced. The voids made by the running sand during the construction of the tunnel probably were filled with clay later, as described, thus stopping the leaks.

The tunnel at Cortland street, formerly Clybourn place, built in 1907 was in clay at an approximate depth of 43 ft. below datum. While this depth was not enough to escape the bottom of the foundation piles of the bridge, it was sufficient to leave a good margin of solid material between the bottom of the tunnel and the gravelly water bearing substance which generally directly overlies the rock. A curve of 17°7′ was put in about 62 ft. long to bring the tunnel near the outer edge of the foundation.

When the piles were encountered, about 60 in number, 45 were cut off from 5 to 7 ft. and the remainder about 1 ft. from the bottom. The cutting extended about 1 ft. above the outer line of the concrete and about double the thickness of concrete was put in where the piles were in order to make the strength greater at these points. Thus we were enabled to build this tunnel in good material and saved the expense of going 20 or 30 ft. deeper and building in rock.

The Quarry street tunnel had to be built in rock as there was not sufficient material to build in clay, rock being 50 ft. below datum and the ground consisting of swelling clay. Difficulty was experienced in using rings as they became distorted and it was necessary to build timber shafts to rock, where the blasting was begun and the tunnel started about 20 ft. below the top of rock. A covering of 10 to 12 ft. of rock is desirable as the upper part of rock is usually seamy and has fissures bearing water. At the depth of about 30 ft. below datum a stratum of gravel 3 ft. thick was met which caused a large volume of water and also an oily substance resembling petroleum to penetrate the

shaft. This may have been the residue from a gas plant in the vicinity.

It was necessary to keep the pumps going 24 hours a day during construction. When the shafts were concreted they were plastered with rich mortar and the water was allowed to enter through a 2-in. pipe which was afterwards plugged.

Tunnels for electric cables need not necessarily be water tight, which is fortunate, since this condition is very hard to obtain. Good lead sheathes prevent any moisture entering the insulation and thus no damage is done. Many conduits where sewers are so high as to prevent drainage contain cables which are always in water but this condition is avoided wherever possible. As a matter of fact, the presence of water is really an advantage, because the cables are able to dissipate heat more rapidly, hence can carry heavier load with less likelihood of breaking down.

Tunnels are made as nearly water tight as practical without going to too great an expense as, for instance, the use of some of the various waterproofing materials which are on the market but which would be quite expensive for use in tunnels. They are used to advantage in basements and other places where the water pressure is not so great as in tunnels.

The last tunnel, built at Harrison street in 1918, was different from any of the others as it was built diagonally across Harrison street, the east shaft being on the south side of the street and the west shaft on the north side.

This was necessary in order to keep away from the city water tunnel on the north side and to utilize the tunnel manhole 15 by 18 ft. in size which had been built on the north side for the 30-duct conduit line built about a year before the tunnel was started. A curve was run in at each end and the tunneling was done from both shafts toward the center. The line checked within ½ in. when the headings met.

During the last 20 years, the period during which these tunnels were constructed, there was not one fatal accident and only one or two of serious nature. On work of this kind, which is extremely hazardous, accidents are sure to happen. For instance, in one or two cases a box or bucket containing dynamite has fallen down one of the shafts and occasionally a plank or a tool fell down but fortunately no damage resulted.

The tunnels are all very well built and entirely satisfactory for the purpose for which they were constructed and have much more than saved their cost by the offset of additional conduit and cable which would have been necessary had they not been built.

The unit costs paid in building Harrison street tunnel in 1918 are given below, but these costs may be greater at present, due to the variation in labor costs:

	Per day of 8 hours.
Foreman	$8.00
Engineer	6.00
Miners	5.25
Muckers	4.00
Topmen	4.00
Watchman	3.00
Laborers	4.00
Blacksmith	6.00
Carpenter	7.00
Plasterer	7.00
Team	7.00
Timekeeper	5.00

Supervision and design on this class of tunnel work cost 5% of the total, of which approximately 4% is for supervision. As a matter of fact, to be on the side of safety, 10% of the total cost is usually added to an estimate, for engineering and contingencies, to cover any unusual expenses which cannot always be anticipated.

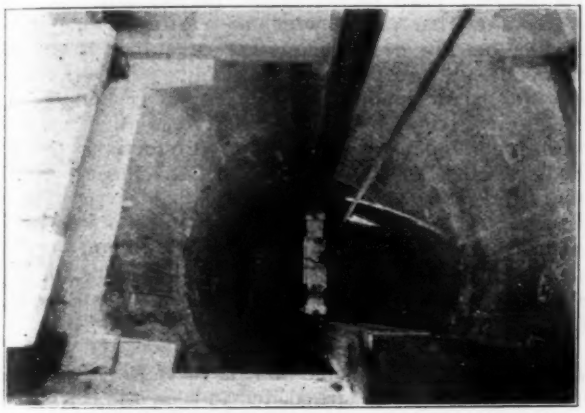

Fig. 9.—Concreting Completed and Elevator Installed in Shaft.

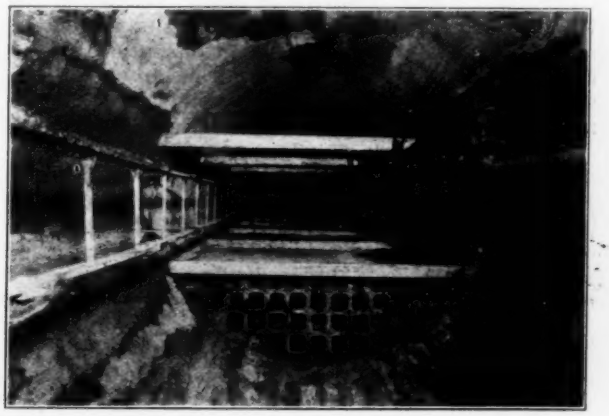

Fig. 10.—Concreting Completed, Galvanized Iron Angles Supporting Tile Conduit.

Advantages of Tunnels.

The expediency of building tunnels for river crossings can readily be seen by making a few comparisons.

The old method of installing submarine cables and long since abandoned proved its own undoing. The first cost is large when one considers that the mere installation of a submarine cable in the bed of the river costs about $500. Add to this the expense of repairs and further costs of reinstallation every time a dredging machine picks one up as well as the loss due to interrupted service and the advisability of building tunnels at certain intervals depending upon density of load becomes apparent.

On the other hand, a question may arise as to how far apart it would pay to build tunnels. Take a simple case where two tunnels are a mile or a mile and one-half apart, supposing it is decided to run a cable for one-half the distance one side of the river to the tunnel and back on the opposite side. A mile of cable and, say, a four-duct conduit line would total in cost, roughly, $10,000. Add two or more cables and the cost of a tunnel is expended so that tunnels are without question a very economical form of investment for a central-station company in a city like Chicago.

Effect of the War Upon Isolated Plant Costs

Compilation of Isolated Plant Operating Costs for Different Years —Comparison of Expenses for Central Station and Isolated Plant

DURING the past few years prices have been advancing in a manner unprecedented in the history of central stations. This advance has been reflected in the price of practically every commodity and has been felt by every human being.

The isolated plant owner has not been without the scope of its influence, not alone in the matter of costs, but as well in the question of quality of labor employed and in material and equipment purchased. There has also been introduced a number of questions which the owner heretofore did not appreciate existed, but which he now knows are inherent in plant operation. These questions he must consider in the future in determining the relative merits of central-station supply and of isolated plant operation. They, however, suggest an entirely new line of thought in advertising and sales campaigns for this class of business which will be developed as we proceed.

If we plot either actual prices or index numbers of prices preceding the declaration of war, August, 1914, but excluding panics and depressions and their opposite, abnormal prosperity, we will find that the curve will show advances with marked regularity and following very closely the gradually increasing higher level of living.

The prices of practically every commodity seem to be cyclical, passing through periods of enhancing value only to recede, but in normal times seldom to the previous minimum point. Prices in general pass through a cyclical period, but of a longer duration, having, however, all the characteristics of the individual commodity cycle, except as to the time element.

The fluctuations in prices are ever present and the power and ability to purchase when prices are low and sell when high very frequently distinguishes the successful from the unsuccessful business. Purchases and sales must in general anticipate the high and low points of these cycles.

The business of producing current by isolated plant can to only a very small degree take advantage of cyclical purchases, utilization or sales. It must purchase labor, coal and other commodities as required by the constantly fluctuating demands, eliminating almost entirely the advantages accruing to other classes of business who are enabled to purchase and store in quantities when prices are low and whose unfilled orders represent the production of plant capacity for months in advance.

Though it might be expected that current generated by isolated plant follows the same general characteristics of production, the object of manufacture, the opportunity to purchase in quantity the raw materials of current generation is very limited as compared with the opportunity to purchase raw materials for production. The time element of current generation raw material purchases is short as compared with the time element opportunity to purchase raw materials for production.

In the term "current generation raw material" is included such items as boiler, engine and generator equipment, labor and coal, in contrast with the term "production," meaning the final product manufactured.

Very slight expansion or contraction of the time element may permit of advantageous purchases. When, however, the demand for raw material takes a very rapid rise, coinciding with a period of restricted production, the consequent disadvantageous condition is materially amplified and precludes any opportunity to make advantageous purchases. The problem then is to purchase at any price.

Such were the conditions prevailing during the last few years. Plant owners were further handicapped by the fact that plants which heretofore had a reasonable margin of capacity were required to carry overloads and to operate longer hours per day. Not only were plants inadequate from a capacity standpoint, but as well from the standpoint of regulation and its effect upon quantity and quality production. Plant labor, because of its knowledge of machinery, came under the influence of higher wages paid by munition plants, etc., increasing wages paid to this class of labor by substantial figures. The continuous operation of the power plant was necessarily one of the essential factors in winning the war and it had to pay the price.

Plant installations made to meet normal conditions were allowed a reasonable margin of capacity varying with each plant. Abnormal demands in the load utilized this margin capacity, necessitating the installation of additional equipment, if such could be procured. The space occupied by the original plant was believed to be adequate for the building needs and addition thereto very frequently encroached upon space then used for the more important purpose of producing goods upon which profits depended.

Except in a few cases of careful design, the plant was almost invariably in a congested and out-of-the-way place. When additions were necessary under circumstances existing in the last few years, space never intended for plant equipment was utilized at a considerably greater expense than during normal times.

Heretofore the turnover of plant labor had not been a serious matter, this labor appearing to be satisfied with its employment, the quantity of work and responsibility involved and the wage paid, these conditions varying with each establishment. Plant employes, because of age or partial physical disability, doubting its ability to cope with the intensive war conditions, continued in the same position at an advanced wage. The more physically fit took advantage of the better opportunities offered, although these opportunities proved to be of a temporary nature. Past experience has demonstrated that this class of labor seldom suffers a reduction of wage.

Whereas, the price of labor was governed principally by the law of supply and demand, the price of coal was regulated by the Government. The Fuel Administration fixed the price of coal at the mines to which was added a 75-cent differential allowed only

the individual operator. The freight charge was fixed, varying with the location of the mine, the kind of coal handled and the carrying railroad. A war tax of 3% on the freight charge and the dealer's margin of $2.50, Philadelphia territory, combined with the other items mentioned above, made up the price of anthracite coal per ton.

The 75-cent differential was omitted in determining the price of bituminous coal. The dealer's margin was not regulated.

Recent figures seem to indicate that the dealer's margin of $2.50, while a reasonable charge for 1916 and the earlier part of 1918, was too low for the months of January and February, 1919, the analysis showing the retail costs for these months to be $2.94, not including dealer's profit as compared with the $2.50, which included profits.

An unsuccessful attempt was made to combine all grades of coal with the several charges outlined above to determine an average price per ton. The difficulties experienced in attempting to arrive at an average figure per ton were due to the fact that all grades of coal were purchased from company and individual operators, and carried over different roads.

Some idea of the increase in coal prices per ton 1918 over 1916 may be obtained from a study of 25 cases as follows:

	Coal cost per 2000 lb. buckwheat* (1)	(2)
1918 average	$6.79	$6.00
1916 average	3.90	3.47
Increase	$2.89	$2.57
Increase, %	74	74

*The foregoing prices are the averages of prices paid and not weighted average.

For the purpose of obtaining some idea of the influence of rising prices on plant operating costs, a letter was issued to a number of member companies requesting operating cost data of plants for the years of 1916 and 1918, the estimated cost of heating, the competitive cost and the central-station charge for similar service.

Table No. 1 is a specimen of the form and substance of the data received.

TABLE 1.

Operating Expenses.	Year ending March 1, 1916.	March 25, 1918.
Coal	$ 6262.93	$10800.00
Labor	4732.00	5420.00
Oil, waste and supplies	202.17	230.00
Ash removal (free in 1916)		250.00
Repairs and renewals	100.00	500.00
Water	300.00	300.00
	$11597.10	$17500.00*
Heating	5106.00	6344.00†
Competitive cost	$ 6491.10	$11156.00‡
Cost of central-station service	9674.40	9674.46
Loss	$ 3183.30	Sav. $ 1481.60

Increase, %: *50.9, †24.2, ‡71.0.

DETAILS OF OPERATING EXPENSES.

Kilowatt-hours.
The kw-hr. based upon test equals 239,150
Same figure has been assumed for 1918.

Coal.
Total coal, 1916..1761 tons No. 1 buckwheat, @ $3.58 average
Total coal, 1918..1800 tons No. 1 buckwheat, @ $6.00 average

Labor.

	1916.	1918.
Chief engineer	$1300.00	$1500.00
Assistant engineer	988.00	1200.00
Assistant engineer	936.00	1040.00
Fireman	780.00	340.00
Helper	728.00	840.00
	$4732.00	$5420.00

Heating Estimate.

Coal, 540 tons	$2106.00	$3240.00
Water	250.00	250.00

Labor.

One engineer	1300.00	1300.00
One engineer	936.00	936.00
One fireman at $17 (7 months)	514.00	514.00
Total	$5106.00	$6344.00

The operating expenses in the case cited are given for years ending March 1, 1916, and March 25, 1918, and show an increase of 50.9%. The heating estimate shows an increase of 24.2%, which has been determined by applying the known 1916 and 1918 unit prices to the estimated quantities. The cost of central-station service is based on the metered kilowatt-hours for 1916 period and the prevailing rate for 1916 and 1918 period. The details of the operating expenses are given for reference. The case typifies the method pursued in studying other cases.

Of the cases reported, five have been selected because of their completeness of detail and that they more nearly represent prevailing conditions. These cases have been carefully analyzed and the results tabulated in the following tables and shown in the several curves.

TABLE 2.

Kilowatt-hours, per cent increase operating, heating and competitive expenses.

	Annual kw-hr.	Increase in %, 1918 over 1916. Operating.	Heating.	Competitive.
A (1916)	32,000	79.9	50.8	147.0
A (1918)	36,000			
B	40,000	34.4	47.3	30.6
C	42,000	42.3	46.6	38.2
D	100,000	55.9	38.2	122.0
E	239,150	50.9	24.2	71.0

The absence of any regularity in the percentage operating expense is apparent. One might expect to

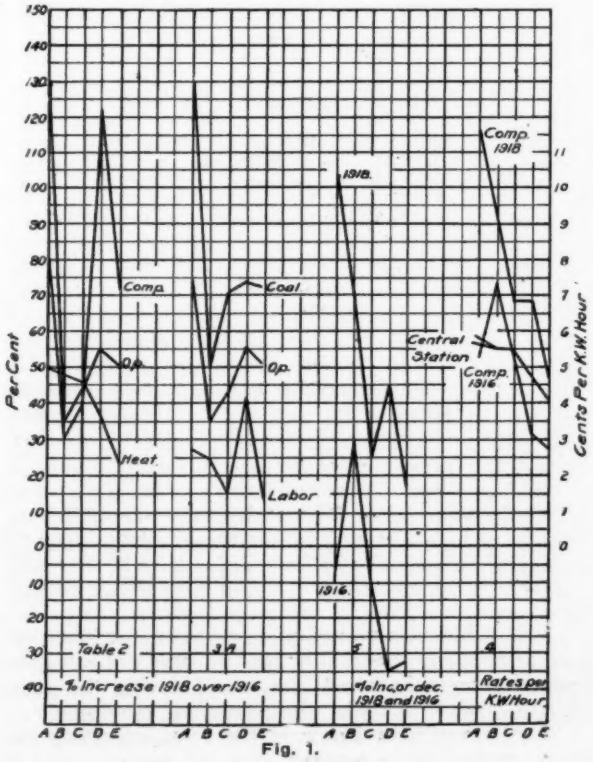

Fig. 1.

find the percentage increase to be somewhat uniform, the absence of which may be partly due to the limited number of cases studied, but there is the evidence that there does exist a wide variance in the cost of production and that there is no definite relation between the kilowatt-hours' output and the operating expense. Each case must be determined upon its merits.

There appears to be no explanation of why the heating percentage increase should not have corresponded to the increase in operating expenses.

Competitive cost percentage increase would, of course, be higher as the heating percentage increase is lower.

TABLE 3.

Percentage of labor and coal to total operating cost.

	Labor		Coal		Labor and coal combined	
	1916	1918	1916	1918	1916	1918
A	42.4	30.2	48.4	61.8	90.8	92.0
B	44.9	43.7	48.5	54.2	93.4	97.9
C	46.5	37.5	45.9	54.9	92.4	92.4
D	26.4	23.5	55.6	61.8	82.0	86.3
E	40.8	31.0	54.0	61.7	94.8	92.7

There has been no substantial change in the relation of coal and labor combined to total operating expense.

As coal was the item most effected by increased prices, labor showed a reduction in the percentage of the total 1918 over 1916. The average combined labor and coal for 1916 for the five cases was 90.8%, whereas in 1918 it was 92.3%. We might expect, therefore, to find that on the average labor and coal will represent approximately 92.3% of the total operating expense.

Table No. 3-A shows the coal and labor expenses and the increase in dollars and per cent 1918 over 1916.

TABLE 3-A.

Labor.	1916.	1918.	Increase.	Increase, %
A	$2444.00	$3120.00	$676.00	27.7
B	1664.00	2080.00	416.00	25.0
C	1860.00	2132.00	272.00	14.6
D	3744.00	5340.00	1596.00	42.0
E	4732.00	5420.00	688.00	14.5
	$14444.00	$18092.00	$3648.00	25.2
Coal.				
A	$2775.00	$6379.00	$3604.00	130.0
B	1800.00	2700.00	900.00	50.0
C	1833.00	3125.00	1292.00	70.4
D	8100.00	14040.00	5940.00	73.7
E	6262.00	10800.00	4538.00	72.4
	$20770.00	$37044.00	$16274.00	78.3
Combined	$35214.00	$55136.00	$19922.00	57.0

TABLE 4.

Cost and rates in cents per kilowatt-hour.

		Operating.	Competitive.	Central station.	Gain or loss in cents per kw-hr.
A	1916	17.8	5.2	5.81	Loss..... 0.61
	1918	28.8	11.6	5.66	Gain..... 5.94
B	1916	9.26	7.19	5.5	Gain..... 1.69
	1918	12.45	9.39	5.5	Gain..... 3.89
C.	1916	9.5	4.94	5.5	Loss..... 0.56
	1918	13.5	6.85	5.5	Gain..... 1.35
D	1916	14.56	3.083	4.75	Loss..... 1.667
	1918	22.71	6.845	4.75	Gain..... 2.095
E	1916	4.83	2.71	4.04	Loss..... 1.32
	1918	7.31	4.66	4.04	Gain..... 0.62

This table was compiled principally for the purpose of showing the gain or loss in cents per kilowatt-hour if current had been purchased during the years of 1916 and 1918 under the prevailing conditions.

The competitive figure is the total operating expense minus the estimated cost of heating, and is assumed to represent the rate the customer could afford to pay, the installation being of such a character as would permit of connection to central-station service without change.

The figures in the central-station column represent the prevailing rates of the companies in the respective field. The difference in the rates of case "A" is due to kilowatt-hour difference. The rates of 1916 were in effect during 1918.

Table No. 4 suggests. Table No. 5, that is, what sum of money should the central station increase or decrease its rates to meet competition? The individual cases are here analyzed.

TABLE 5.

	Dollars		Percentage	
	1916	1918	1916	1918
A	$196.70†	$2138.81*	10.6†	104.0*
B	657.00*	1540.00*	29.6*	69.4*
C	231.20†	571.00*	10.0†	24.5*
D	1667.00†	2095.00*	35.0†	44.0*
E	3183.30†	1481.60*	32.9†	15.3*
	$4621.29†	$7826.41*	22.2†	37.3*

†Decrease; *increase.

The values in Table No. 5 illustrate the desired point, namely, that the central station, to obtain all 1916 business of the five cases at competitive rates, could have increased the rate for case "B" but would have to materially decrease rates to meet the cost of other cases, whereas, to obtain 1918 business, it could have made a very substantial increase in rate. Fig. 1 is a plot of the data of the several tables.

No reference has been made to the fixed charges, as reliable data is not available. Further study will probably show that although no items have been added to the list of fixed charges, the values will be higher in both old and in new plants for the following reasons:

(1) The employment of inefficient and indifferent labor during the war period, with its consequent inattention to repairs and maintenance, will shorten the useful life of the plant.

(2) Plants were overloaded and operated under overloaded conditions for an extended period of time, thereby reducing the useful life.

(3) The quality of oil and materials used was of a lower grade than that heretofore. The effect will be to shorten the life of the plant as well as to increase the cost of repairs and renewals.

(4) Plants reconstructed, added to or new, will be subject to higher fixed charges due to the higher investments and costs of 1918 as compared with 1916.

(5) All plants were subjected to higher insurance charges.

If an investigation of the character outlined herein were instituted by any company and continued over a period of years, it would be able to determine the curve of costs and cost tendencies of isolated plants.

Were we in possession of the data of a large number of cases, analyzed in accordance with the foregoing method, we would find it feasible to classify isolated plant business into groups measured in terms of business-getting-possibilities. This grouping should take into consideration the time element, that is, the probable data when, due to the increasing isolated plant costs and the decreasing central station charges, the group is changed from a group of future prospects to a group of immediate business-getting-possibilities, regardless of the class of business to which each prospect may belong, the capacity of the plant or the form of contract applicable thereto. Thereby,

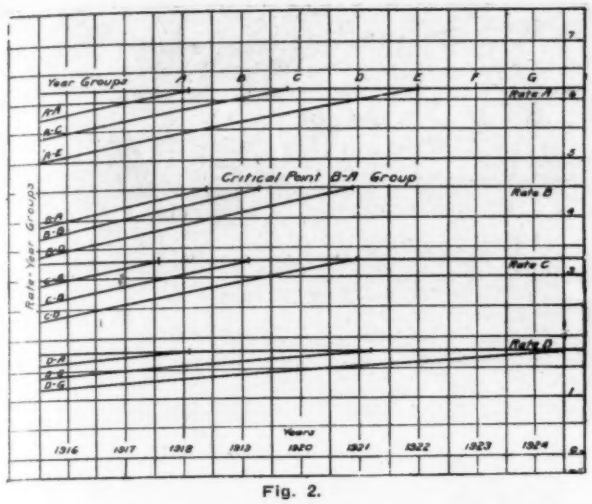

Fig. 2.

EXPLANATION FOR DETERMINING ADVISABILITY OF GROUPING BUSINESS PROSPECTS.

To determine the advisability of subdividing all business into groups which might be known as "Rate Year Groups," the following theoretical plot, Fig. 2, has been prepared.

The years have been plotted against the rate per kilowatt-hour. Four rates for central-station service have been assumed as constant for the years 1916 to 1924, inclusive, namely, rate A at 6.2 cents, rate B at 4.5 cents, rate C at 3.3 cents, and rate D at 1.8 cents.

Lines "A-A" to "D-G", inclusive, have been drawn showing arbitrarily assumed cost tendencies of isolated plants by years.

The year of 1918 has been assumed as the "A" year group, 1919 as the "B" group, and so on.

The point taken as a means of classifying the various cases into groups is the "critical cost point." Thus any individual case crossing the central-station line during the year of 1918 would be classed in the "A" group regardless of the capacity, etc. The "critical cost point" in relation to the "time element" determines the status of each case with reference to its business getting possibility.

The "A" groups, being all the cases reaching the critical cost line during 1918, should be further classified into groups according to the rate they could earn. Thus, year "A" groups crossing rate "A" would be classified as rate-year "A-A" groups, etc., etc.

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the selective method of obtaining isolated plant business would be carried to its logical conclusion.

Had there been no war, it is probable that by this time considerable isolated plant business would have come within the scope of central-station operation. As a result of the war we have been placed in an advantageous position.

Plant costs have materially advanced, whereas, central-station rates have been practically constant. The point of contact between these competitive elements has been reached and passed and is now in favor of central station. This point of contact might well be termed the "critical cost point."

The success in developing isolated plant business will be governed by the extent to which all the forces in our possession are co-ordinated, including a more intimate knowledge of present costs and their relation to the past, with a possible insight into the future, the efficiency and enthusiasm of the sales force, the nature and the timeliness of advertising matter. It will also include the proper selection of business at or beyond the critical cost point.

The continuous accumulation of adequate and reliable cost data as a means of determining the critical cost point could be made of inestimable value to the sales force.

FRENCH RAILWAY OFFICIALS AND ENGINEERS INSPECT ELECTRIFIED LINES.

Electrified Sections of Chicago, Milwaukee & St. Paul Railroad Visited.

H. B. Earling, general manager of the C. M. & St. Paul Railway Co., and R. Beeuwkes, electrical engineer in charge of the electrification work, recently conducted a party of French government and railway officials over the electrified line of that company in Montana and Washington. The purpose of the visiting party was to inspect the company's equipment, to secure data on tractive power, speed, and the character of construction work. Mr. Earling and Mr. Beeuwkes met the visitors en route west at Mobridge, S. D., and conducted them from there to Seattle.

The information thus obtained by the French officials and engineers is for use in a report to their government on the advisability of the electrification of all railroad lines of France.

The inspection party was composed of the following gentlemen:

Prof. Mauduit, of Nancy university, and Major d'Anglards, of the ministry of transports, delegates of the ministry of public works and transports; M. Pomey and M. LeCorbeiller, telegraph engineers for the French government and delegates of the minister of telegraphs; M. Bachellery, assistant manager, and M. Leboucher, assistant motive power superintendent of the Midi railway; M. Japiot, chief mechanical engineer, and M. Ferrand, electrical engineer of the Paris, Lyons and Mediterranean railroad; M. Sabouret, assistant manager, Paris-Orleans railroad; M. Balling, chief engineer, Paris-Orleans railroad; M. Parodi, chief electrical engineer, Paris-Orleans railroad; M. Debray, chief electrical engineer, French State railways; M. Barillot, electrical engineer, French State railways.

WATER POWER DEVELOPMENT IN NEW SOUTH WALES.

In the State of New South Wales there is under consideration a scheme of hydroelectric development of the Nymboida river. It is estimated that the cost would be about $175,000, and would comprise in part alterations to tunnel inlet works on the river, the installation of two 800-kw. generators, a transmission line of 23 miles, and a distribution system in the towns of Grafton and South Grafton. It is the purpose to furnish power to farmers along the way for small engines as well as to the towns of Grafton and South Grafton.

When the great Burrenjack Dam, in connection with the Murrumbidgee irrigation scheme, was under construction the possibilities for hydroelectric development were also considered. Apart from the large volume of water drawn from the reservoir for irrigation purposes, a small continuous supply will be released for domestic, stock, and riparian requirements. By this release there will be always available from the reservoir the equivalent of 165 cu. ft. of water per second discharged under a head of 100 ft. This is equivalent to approximately 1400 kw. at the dam, 05, converted into electricity and transmitted to a distance of 100 miles, 938 kw., or 8,217,000 kw-hr. per annum. The power thus generated could be utilized by about six or eight towns within a radius of 100 miles of the dam.

Foundation Excavation of Power House Site, Showing Tunnel Openings for Penstocks.

Structural Details of Plant Extension at Niagara Falls

Plant Extension by Hydro-Electric Power Commission to Increase Capacity by 40,000-Hp.—Structural Features—Equipment Involved

IN 1918 the Hydro-Electric Power Commission of Ontario decided to enlarge the plant of the Ontario Power Co., which had been acquired by the Commission. The enlargement of this plant, wholly an emergency measure calculated to provide energy pending the completion of the larger Queenston-Chippewa development at Niagara Falls, Ont., consisted of the installation of a third conduit, parallel to the two existing conduits, and the construction of an addition to the old power house. Completion of the work within 12 months after it was started in March, 1918, not only adds from 40,000 to 50,000 hp. to the plant, but also constitutes a neat record of attainment for the engineers entrusted with the work. Although the demand for energy created by the war emergency has ceased to exist, the demand created by the large number of new industries attracted by the power facilities offered by the Hydro-Electric Power Commission has already appropriated a large part of the additional output provided by the new unit.

The Original Plant.

The original plant as existing before the recently installed addition consisted of a forebay, two conduits and their respective surge tanks, the necessary penstocks, power house, turbines and generators. No addition to the forebay to accommodate the new conduit was necessary since the forebay and gatehouse were built to accommodate a third conduit. The arrangement of the forebay is such that an accumulation of ice above the entrance to the conduits is very improbable. That the forebay accommodation is adequate is indicated by the fact that a blind thimble 20 ft. in diameter to provide for an extension was installed when the gatehouse was erected.

The two original conduits, the diameters and lengths of which are, respectively, 18 and 6600 ft., are capable of delivering sufficient water to develop 162,000 hp. Conduit No. 1, the first one constructed, was built in 1903 of steel plate imbedded in concrete, whereas conduit No. 2 was built of reinforced concrete placed on a continuous concrete saddle. The two conduits terminate in surge tanks of different kinds and deliver through penstocks directing the water down to the power house at the lower level below the falls. Conduits Nos. 1 and 2 deliver through six and eight penstocks respectively. Surge tank No. 1, a simple tank type with small capacity, prevents surge pressure during intervals of load rejection by means of an overflow into a spillway. Surge tank No. 2, however, the first of the Johnson differential type ever constructed, is capable of acting as a regulator for the plant as a whole, by reason of its size and differential action. It also is equipped with an overflow leading to a spillway.

The mechanical equipment driven by the two old conduits consists of 14 turbines with a rated capacity of 189,600 b-hp. directly connected to generators with a rated capacity of 149,000 kv-a.

The New Conduit No. 3.

Conduit No. 3, the one recently constructed, consists of a 13.5-ft. diameter wood-stave pipe 6700 ft. long, uniting the gatehouse and the surge tank and penstocks. Connection is made with the 20-ft. diameter thimble at the gatehouse by means of a reinforced concrete reducer 25 ft. long. The connection between the wood-stave pipe and the concrete reducer is made by means of another steel thimble 13.5 ft. in diameter and 6 ft. long. This thimble, which projects 2 ft. from the concrete reducer, extends 1½ ft. into the wood-stave barrel. The union between the wood and thimble was sealed by tightening the bands around the staves. Connection with the surge tank and penstocks is made by means of a steel distributor, the diameter and length of which are 13.5 and 179.5 ft., respectively. The steel distributor is united to a section of reinforced concrete pipe leading to the surge tank. The concrete pipe is laid on a horizontal curve, the end of which bends upward through 90° to form an elbow connection with the center of the bottom of the surge tank.

Details of Conduit.

A section of the pipe 1000 ft. long adjacent to the forebay, and a section 825 ft. long adjacent to the

Channeling and Drilling in Section of Ditch Passing Through Rock.

steel distributor, are incased in concrete as a means of protecting the upper portion. The conduit is protected from variable water pressure on the outside by means of two vitrified drains extending along the sides of the conduit from station 9 + 00 to the penstock. They discharge into the penstock drains which conduct the drainage water down through the power house to the lower level of the river. The first 300-ft. section of the drain is 6 in. in diameter, whereas the rest is 8 in. The two drains are interconnected at 200-ft. intervals by 6-in. horizontal laterals laid under the conduit.

Saddles which are built of timber pieces bolted together support the conduit throughout its lower semi-circumference. They served also during the construction work as forms for the lower half of the conduit. These saddles were designed not only to support the finished conduit in its proper line and grade, but also to prevent diametral deformation caused by uneven settlement of backfill, or uneven hydrostatic pressure, when the pipe may not be running full. Prevention of spreading of the upper ends of the saddles is obtained by cantilever action in the upper 3 ft. of the ribs of the saddles. The cantilever action is obtained by the stiffening effect of two ¾-in. bands in each saddle, which enter the structure of the saddle about 3 ft. below the tops of the ribs, which pass around under the lower side of the conduit and which react against heavy cast-iron washers braced against diagonal offsets in the ribs of the saddles.

Details of the Steel Distributor and Penstocks.

The steel distributor, which extends between stations 66+77 and 68+56.5, is connected to four steel penstocks by means of as many reducing tees riveted to the distributor. The tees are constructed of ½-in. plates riveted together in sections cut from beaver board patterns. In preparing the patterns, wood frames were built around the shop-assembled distributors in such a manner that the framework resembled joists or ribs shaping the tees. The beaver board strips were tacked to these joints, were match-marked and were used as patterns from which to lay out the corresponding steel plates. The patterned plates later were sheared, punched and assembled and bolted to the distributors to insure their assembly in the field.

Conduit No. 3 is connected with the turbines through penstocks Nos. 15 and 16. These penstocks are built up of steel plates ⅜ in. thick at the upper end and 13/16 in. at the bottom. The thickness of the plates is designed to accommodate the maximum static head that will occur, the dynamic head caused by closing the turbine gates in 3 sec. with relief valve closed, and the deterioration of the metal on account of wear and corrosion. The effective head resulting from the combined static and dynamic heads is 150 ft. at the upper end of the penstock and 320 ft. at the lower end. Unit stresses adopted in designing the penstocks to resist the static heads only, exclusive of metal provided to compensate for corrosion, were 15,000 lb. per sq. in. for tension, 10,000 for shear and 20,000 for compression. The desirability of maintaining maximum joint efficiency necessitated a change in the type of longitudinal joints as the thickness of the shell changed. This efficiency was maintained by adopting triple riveted lap construction in longitudinal seams in plates varying from 3/8 to 7/16 in. and by adopting triple riveted butt construction in the seams in plates thicker than 7/16 in. Single riveted lap construction was adopted for the circumferential joints.

The new penstocks, the lengths of which are 216.2 ft., drop vertically through 48.3 ft. from the distributor, then bend 45° and extend 99 ft. toward the power house, and then bend 45° more and extend horizontally into the power house. Each penstock tube, which is surrounded by lean concrete containing a 12-in. drain discharging into the corresponding draft tube, terminates in a reducer with two openings making 90° horizontal bends from the axis of the horizontal portion of the delivery end of the penstock. The flanges on the openings of a reducer are bolted to the metal casing of the turbine. The steel plates for the penstocks were assembled in place. Two 10-ft. and two 10.5-ft. valves responding to hydraulic control are set with their top ends approximately 20 ft. below the center line of the distributor.

The Differential Type, Johnson Surge Tank.

The outer diameter and height of which are 60 and 78 ft., respectively, is centered over the vertical

Excavation for Conduit No. 3 and Method of Supporting Old Steel Sheet Piling.

13.5-ft. concrete pipe connecting the tank with the distributor. The steel bottom of the tank, which is constructed of ½-in. flat plates, field riveted, rests on a carefully leveled 2-in. grout course spread over a

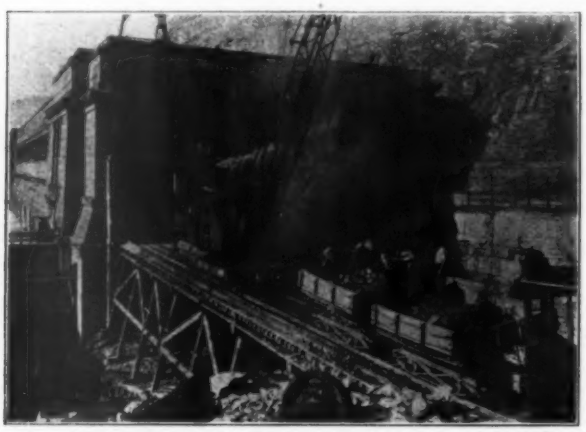
thin concrete footing poured on the solid rock. A circular steel riser 12 ft. in diameter by 69 high, extends upward from the bottom of the tank, providing a 9-in. opening around the outer side of the riser for the lower ports. This ring is divided into 12 ports, the area of each of which is 2.4 sq. ft. Two ports over the short turn of the inlet pipe are to be sealed, since they are not deemed necessary to the calculated functioning of the tank. Another horizontal group of ports is placed in the riser 34 ft. above the bottom of the tank. The steel bottom supports the riser by means of brackets to which bottom and riser are riveted. Circumferential angles riveted to the riser at regular intervals provide the necessary rigidity to resist unbalanced internal and external pressure caused by a head outside of the riser.

The thickness of the shell of the tank varies gradually from 1 in. at the bottom to ¼ in. at the top. Anchors with turnbuckles connect the steel roof trusses supporting the timber roof with the riser to prevent vibration during load changes.

Details of Power House.

Concrete and structural steel were selected for material from which to construct the power house. The substructure and rear wall are designed to act as gravity structures, whereas the front and north walls and the roof are designed to act as reinforced structures. The steel work for the interior columns, roof trusses and crane were designed to act independently of the walls, so that it could serve in place of falsework for the erection of the machinery. A standard gage track, which enters the north wall at elevation 368, is provided in the new portion of the power house as an extension of this track through the old portion. It is laid along an incline from the power house to a connection with the International Street Railway at the top of the bank near the International bridge.

Some details of the new addition to the power house are different from similar details in the old structure. These details include the elevation of the axis of the turbines, the arrangement of the spillway and necessarily the design of the front wall. A weir was built below the draft tubes of units Nos. 1 to 14, the crest of which was placed at elevation 353, where-



Temporary Construction Trestle at Power House Site.

as normal elevation of Niagara river is 343. This difference of elevation results in an approximate loss of head of 10 ft. in the old units almost continuously. By lowering the weir below the draft tubes of units 15 and 16, it was possible to set the new turbine units and floor 10 ft. lower than the old units and floor. The elevations of the old and new floor levels are 368 and 358, respectively.

Lowering the floor in the new portion of the power house necessitated considerable care in the design of

Tunnel Under International Railway Tracks and Channeled Walls.

the two exposed walls. The section of the new portion of the front wall was fixed by the section of the old portion, although the new portion extends 10 ft. lower than the old portion. The fact that the front wall is intended to act as a cantilever to resist a 40-ft. head caused by a 50-ft. rise of the water level in flood time necessitated the use of an unusual amount of reinforcing steel. The elevation of the window sill, which was raised after the flood of 1909 broke through the windows and flooded the power house, is fixed at 388. Raising the sills in the old portion of the wall required the strengthening of this portion, a fact which had to be considered in the design of the new extension. A semi-reinforced cantilever and gravity section was adopted for the end wall which is subjected to the same pressure caused by flood waters as the pressure to which the front wall is subjected. The opening in this wall required to accommodate the entrance of cars can, if necessary, be sealed by stop logs in time of high water.

No special considerations were necessary in the design of the rear wall on account of the fact that the lower portion of it is set 20 ft. into solid rock. The wall was designed to act as a stepped gravity structure, although some reinforcing steel was provided along the inner vertical face and about openings for drains and conduits as a means of compensating for the concrete eliminated. The wall extends from elevations 357 to 414.5. A 6-in. reinforced concrete slab roof, designed to support 150 lb. per sq. ft. moving load, was adopted for the new portion of the power house to provide against accidents caused by rocks falling from the cliff, or by water flowing down the cliff and freezing on the roof. Drains from the roof which extend downward along the inner side of the front wall discharge into the outer end of the draft tube. Those which extend downward through the concrete in the rear wall discharge into the 2 by 5-ft. longitudinal drain, the elevation of the invert of which is 377.5, extends throughout the back wall, and discharges at its east end. The concrete for the power house is placed by the pneumatic process.

A common sump served by centrifugal pumps is used to drain the interior of the new building. This

sump is situated at the north end of a trough extending across the building between the new turbine units into which all minor floor drains discharge. Only one pump is required to keep the sump empty, although two are provided to insure proper drainage in case one

Draft Tube and Tailrace Form in Place on Power House Site.

of the pumps fails to function. Each pump is driven by a direct-connected 30-hp., 25-cycle, 220-volt motor, has a 10-in. suction, and delivers 1500 gal. per min.

Mechanical Equipment.

The turbines, which are double runner, central discharge units with spiral casings, operate at 187.5 r.p.m. and deliver 20,000 hp. at 180-ft. head. They discharge into the circular end of the draft tube, the axis of which is vertical. The draft tube bends through a vertical curve of 90° and changes from a circular section to a rectangular section of such dimensions that the horizontal velocity of the discharged water is 4 ft. per sec.

The generators are of 15,000 kv-a. capacity, 12,000 volts, 3-phase, 25 cycles, turning at 187.5 r.p.m. These generators are cooled by fans located in the generator pits which draw air as desired from either the interior or the exterior of the power house.

Excavating.

Means employed to excavate the trench depended upon the material and the situation of the trench. The rock was plastered where possible and was channeled where blasting was dangerous to the adjacent conduit. Blasting was used only where the distance between center lines of conduit No. 2 and proposed conduit No. 3 were separated more than 24 ft. Even where blasting was resorted to, it was done on the side of the trench away from conduit No. 2. Channeling was done on the entire near side of the trench and on the outside along the rock portions along which the center lines of conduits No. 2 and No. 3 were 24 ft. or less apart. The material was taken from the trench by locomotive cranes, derricks or shovels, depending on the material and other conditions. In earth cut, one side of the trench was allowed to slope but the other side was held vertical by the old steel sheet piling driven along the trench when conduit No. 2 was built. This piling had to be braced by sills stretched along the top and held by wire cables anchored in solid ground beside conduit No. 1. The excavated material was disposed of locally by dumping some of it in uneven places along the bank in front of Victoria Park and by using the rest for backfill.

A tunnel crossing under the International Railway tracks was adopted instead of an open cut on account of the fact that the solid rock extends to the surface of the ground. The crown thickness under the tracks was between 4 and 5 ft. The fact that the tracks crossed diagonally was not particularly detrimental to making the tunnel. Channeling was necessary in all surface cuts near the surge tank on account of the presence of the old surge tanks and other installed equipment. The rock in the penstock tubes and in the excavation for the addition to the power house was blasted and removed by cars which were loaded by cranes and dump buckets. Careful scaling of loose stone on the cliff had to be done before work could be started with safety on the power house excavation.

All permanent machinery and other parts of the new unit No. 3 were shipped in sections and were field-assembled on account of the large size of the parts. Even handling the sections of some of the equipment required the use of heavy derricks. The valves in the penstocks were handled by temporary derricks but the turbines and power house machinery was handled by means of the permanent crane erected as a part of the power house.

The conduits cross at station 5 the Dufferin Island channel, a small stream which enters the Niagara river a few hundred feet downstream from the gatehouse. This stream was dammed while work on the conduit was in progress. Seepage through the rock into that portion of the trench between the gatehouse and Dufferin Island, which was considerable, however, was a source of trouble. The trench was drained satisfactorily by a low-lift centrifugal pump with 18-in. suction operated by a 50-hp. motor.

Experimental Studies.

Experiments to determine the hydraulic characteristics of units Nos. 1 and 2 were performed before unit No. 3 was installed. These tests were made not only on the conduits, but on the penstocks. Considerable information was obtained from these tests which was useful in the design of unit No. 3. Some of the information obtained is that the head of water over the top of the lower end of the conduit must be 8 ft. to maintain a full barrel when the plant is in operation, and that the order of desirability of material for lining the conduits, based on the coefficient of

Castings for New Turbines.

roughness, is concrete, wood and steel. The coefficient of roughness of concrete is only slightly larger than that of wood, but that of steel is considerably larger than that of concrete or wood. The maximum total loss of head between gatehouse and penstock is 32 ft.,

the velocity in the conduit will be between 19.2 and 20.5 ft. per sec., the quantity of water discharged will be between 2750 and 2930 cu. ft. per sec., and the corresponding turbine horsepower developed will be between 45,000 and 48,000. The controlling elevations

New Conduit No. 3, Old Concrete Conduit No. 2, and 8-In. Tile Drain.

are: At the forebay, 554; at center of distributor over penstock, 507.25; at axis of turbine, 363.40, and at the mouth of the draft tube, 337.50.

PERSONNEL.

The construction of unit No. 3 was affected by force account under the direction of the technical staff of the Hydro-Electric Power Commission of Ontario, of which Sir Adam Beck is chairman and F. A. Gaby is chief engineer. The technical staff responsible for the design and construction includes H. G. Acres, hydraulic engineer; T. H. Hogg, assistant hydraulic engineer; M. V. Sauer, designing hydraulic engineer; E. T. Brandon, electrical engineer; A. H. Hull, assistant electrical engineer; A. V. Trimble, construction engineer; Walter Jackson, resident engineer; J. F.

Details of Saddles. View Shows Well the Comparative Size of Conduit No. 3.

McGraw, general superintendent of construction; F. A. Burgar, field superintendent.

The Metropolitan Edison Co. of Reading, Pa., reports that during the past year it passed the 10,000 mark in number of customers receiving service. Even under the many war restrictions placed upon business during 1918 the company made a net increase of 426 customers during the year.

TRANSITION PERIOD IN ELECTROCHEMICAL AND ELECTROMETALLURGICAL INDUSTRIES IN FRANCE.

New Uses for Energy, Surplus Production and Market Control Features.

War has given to certain products of the electrochemical and electrometallurgical industries a development larger than required by the peace market. For instance the production of carbide during the last four years has increased by four. Yet previous to the war the market was fairly supplied. As it is not possible to expect a sufficient increase of peace demands to absorb all that could be produced by the war establishments it will be necessary to reduce the production of carbide to the prewar figures (34,000 tons) to avoid a general fall in price which would cripple this industry. This will free a considerable amount of power and necessitate shutting down a large number of electric furnaces.

The same thing is the case in the industry of the ferroalloys. This last industry will have to compete with the same industry in Norway where it utilizes considerable water power located at proximity of sea ports. The German market which absorbed before the war three-quarters of the French production of ferroalloys is closed.

If the carbide and the ferro-alloys industries will have to go through a difficult period of readaptation it is to be feared that the gigantic installations for the production of nitric acid from cynamide that were erected to supply the need of the explosive industry will not be able to find a sufficient market in the fertilizer industry.

The aluminum industry will adapt itself more rapidly to the new conditions of peace. Its use in the electrical and metallurgical industry are rather promising. It is mainly a question of the relative costs of different materials.

Electric steel will find after a short period of readjustment an increasing market and in both regions of the Alps and of the Loire this industry is assured of an increasing development. Already before the war the world production had increased from 94,802 tons in 1910 to 160,000 tons in 1913. Since the war the world production has increased to much higher values. It is the aim that the French electric steel industry, the first to be initiated, will have a large share of this world expansion which will no doubt continue after the resumption of the steel industry to a normal peace basis.

The reconstruction period will little affect the aluminum and electric steel industry of France but will be trying to the carbide and ferro-alloys industries whereas the cyanamide industry will have to be altogether shifted to new purposes. The organization of the producers in syndicates for the regulation of production and the prevention of competition on the market will greatly ease the handicap inherent to the period of readaptation. These combines will have as their purpose the co-ordination of the production to the consumption, stabilization of the market and the maintenance of equitable prices.

Of 300,000 hp. harnessed in the department of Savoie 100,000 hp. will be uncalled for if new local uses are not found for power. It is to be hoped that in the near future the railroads will be electrified in the Alps and absorb economically a large amount of France's water power.

Comparison of Mechanical Stokers

Classification of Mechanical Stokers—Salient Features of the Different Stokers — Influence of the Stoker Upon Draft, Combustion Chamber, Etc. — Part 1

By ROBERT JUNE

Mechanical Engineer.

STOKER-FIRED furnaces have many advantages over hand-firing, but where a stoker installation is contemplated, there are many features to be considered. It is true that the stokers feed coal to the fire automatically, but if the coal has first to be fed to the stoker hopper by hand, the automatic advantage is lost. In a general way, it may be stated that a stoker installation is not advantageous, except possibly for diminishing smoke, unless the automatic feature is carried to the handling of the coal and ash, as where coal and ash-handling apparatus is not installed there is no saving of labor. In large plants, however, stokers used in conjunction with modern methods of coal storage, coal and ash handling, make possible a large labor saving. In small plants, the labor saving for stokers over hand-fired furnaces, is negligible, and the expense of installation is no less, proportionately, than in large plants. Stokers are, therefore, advisable in small plants only where the saving in fuel will be large, or where the smoke question is important.

Interest on investment, repairs, depreciation and steam required for blast and stoker drive, must all be considered. The upkeep cost will, in general, be higher than for hand-fired furnaces. Stokers, however, make possible the use of cheaper fuels, with as high or higher economy than is obtainable under operating conditions in hand-fired furnaces, with a better grade of fuel. The better efficiency obtainable with a good stoker is due to more even and continuous firing, as against the intermittent firing of the hand-fired furnaces; constant air supply, as against a variation in this supply, to meet varying furnace conditions in hand-fired furnaces; and doing away, to a large extent, with the necessity of working the fires.

Why Stokers Are Efficient.

Mechanical stokers, as a class, are more effective in preventing smoke than hand-firing, for the reason that their continuous action is productive of uniform development of the volatile gases. Where stokers feed irregularly, the effect is identical with hand-firing, and it is necessary not only to employ an auxiliary mixing apparatus, but also to furnish at times an extra supply of air, in order to secure the complete combustion of the volatile gas evolved after a fresh charge of fuel is added. It follows that, for periods of light load, the stoker engine should be throttled down to the lowest possible speed, rather than be started and stopped intermittently.

The high efficiency of mechanical stokers is due to:

1. Uniformity of feed.
2. Proper proportion of air and combustible.
3. Absence of excessive air dilution, as when the fire doors are opened in connection with hand-firing.
4. Self cleaning.

There is a tendency in all stokers to cause a loss of some good fuel through siftings to the ash-pit, and suitable arrangements should be made to reclaim this.

Just as with hand-firing, daily records are essential with any type of stoker. If the most economical results are to be obtained. Only by frequent observation, is it possible to determine the proper adjustment of air supply, depth of fire, and rate of fuel. Don't leave the determination of these items to your fireman's casual guess. The best engineer you can get—in or out of your plant—is the cheapest man to standardize your firing practice.

And once he has formulated standard practice, don't think that all is done and that you and he can go away and forget your stokers. Ten chances to one, your boiler-room crew is constantly changing, and in these days, you have no guarantee that two succeeding shipments of coal will come from the same mine, or that they will be of similar characteristics. Call your engineer back to check up methods and results of firing, every week or two at first. Later, his visits can be cut down to once a month, if conditions warrant, but even with a stable, intelligent and willing boiler-room crew, and uniform coal, the monthly inspection should be rigidly adhered to. Stokers are often condemned by owners as inefficient and inferior to hand-firing, because no particular attention has been paid to them beyond keeping them supplied with coal.

Smoke and Stokers.

The stoker is not a cure-all for the smoke evil. It is a decided alleviative in many cases, and an actual specific in many others, but to say that the installation of stokers will eliminate smoke in any and all circumstances, is to ignore evident facts.

There are any number of plants burning a wide variety of fuels in ordinary hand-fired furnaces, in extension furnaces, and on automatic stokers, that are operating under service conditions practically without smoke. Experience has shown, however, that no plant will operate smokelessly under any and all conditions of service, nor is there any plant in which the degree of smokelessness does not depend upon the operating force.

When fires must be brought up quickly, operatives in handling certain types of stokers will use their slice bars freely to break up the green portion of the fire. In fact, when a load is suddenly thrown on the station the steam pressure can often be maintained only in this way, and such use of the slice bar will cause smoke with the very best type of stoker. In a certain plant, using a highly volatile coal, and operating boilers equipped with ordinary hand-fired furnaces, extension hand-fired furnaces and stokers, in which the boilers with the different types of furnaces were on separate stacks, a difference in smoke from the different types of furnaces was apparent at light loads, but when a heavy load was thrown on the plant, all three stacks would smoke to the same extent, and it was

impossible to judge which type of furnace was on one or the other of the stacks.

While it is absolutely true, and should at all times be remembered that the question of smokelessness is largely one of degree and dependent to a much greater extent than is ordinarily appreciated upon the handling of the fuel and the furnace by the operators, be these furnaces hand-fired or automatically-fired, it is a fact that the best results are obtained with a good stoker, properly operated. The reason for this is, that in

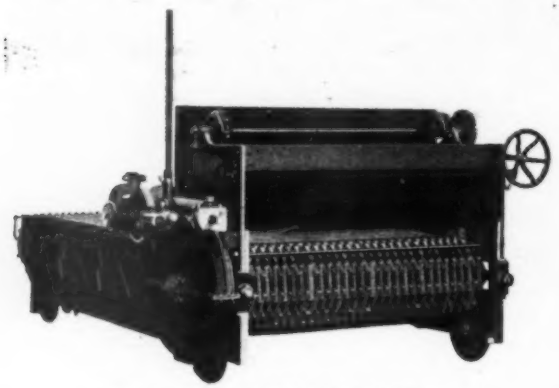


Fig. 1.—B & W Chain-Grate Stoker.

practically all stoker installations, there is, as compared with hand-firing, a much longer time for combustion, the volatile gases as they are distilled being acted upon by ignition arches or other arches, before they strike the heating surfaces. In many instances, stokers are installed with an extension beyond the boiler front, which gives an added length of travel during which the gases are acted upon by the radiant heat from the ignition or supplementary arches, and here again the long travel gives time for the volatile gases to be properly consumed.

Stokers and Labor.

In plants of 2000 hp. and over, the installation of mechanical stokers and coal conveyors effects a considerable saving in labor. With smaller plants, interest on investment, depreciation and other items of expense, may make hand-firing more desirable, although it should be noted that there are stoker equipped plants of 300 hp. which are considered a good investment by their owners.

A stoker of the self-cleaning, slow-running type, requires much less attention than a hand-fired furnace. With hand-firing, one fireman can effectively attend to the water, coal and ashes of about 200 hp. or handle coal for 500 hp., whereas, with good automatic stokers, equipped with overhead bunkers and down spouts, he can readily take care of 4000 hp.

Types of Stokers.

There are three principal types of stokers—chain grate, overfeed and underfeed. In addition, there are several special types, such as down-draft and sprinkler. A classification of the best known American makes follows:

Chain Grate—Babcock & Wilcox, Green, Playford, McKinzie, Illinois, Laclede-Christy, Westinghouse, and Coxe.

Overfeed-Step-Grates-Front-Feed—Roney, Wilkinson and Acme. Step-Grates-Side-Feed: Murphy, Detroit and Model.

Underfeed—Jones, American, Taylor, Riley, Westinghouse and Type "E".

Down-Draft—Hawley.

Sprinkler—Swift, Vulcan, Galt.

Chain Grate Stokers.

The standard type of chain grate is one of the most popular forms of automatic stokers for burning small sizes of high ash and free-burning bituminous coals (30 to 40% volatile matter and 10 to 20% ash). It is also adapted to lignites and the very high ash coals of the West. With low-ash coals at high rate of combustion, the grate is apt to become overheated, and breakage, with attendant high maintenance may result.

The standard chain grate embodies a moving endless chain of grate bars, mounted on a frame with provision for the continuous and uniform feeding of coal into the furnace, the fuel and grate moving together. As usually installed, the fuel surface of the grate is horizontal, though in some designs, it is given a slight incline toward the bridge-wall. The operations of feeding the coal, carrying it through the progressive stages of combustion, removing the ashes and clinkers, and maintaining a clean grate and free air supply, are automatic. The driving mechanism consists of a gear train, actuated by ratchet and pawls, the arms carrying the latter being given a reciprocating motion by an eccentric mounted on a line shaft. The latter may be driven by any type of engine or motor, and the speed of the grate regulated by varying the stroke of the arm carrying the pawls.

The fuel is fed into a hopper placed at the front end of the furnace and the depth of the fuel regulated by a guillotine damper. The front part of the furnace is provided with a flat or slightly inclined arch, the function of which is obvious. The entire grate and driving mechanism is mounted on a permanent truck and may readily be removed from beneath the boiler. The thickness of the fire and the speed of the grate should be so regulated, that when the fuel has reached the end of the grate, it shall have been completely consumed, and incandescent ashes only will be discharged into the pit.

In the earlier forms, chain grates had an objectionable feature, in that the admission of large amounts of excess air at the rear of the furnace through the grates was possible. This objection has

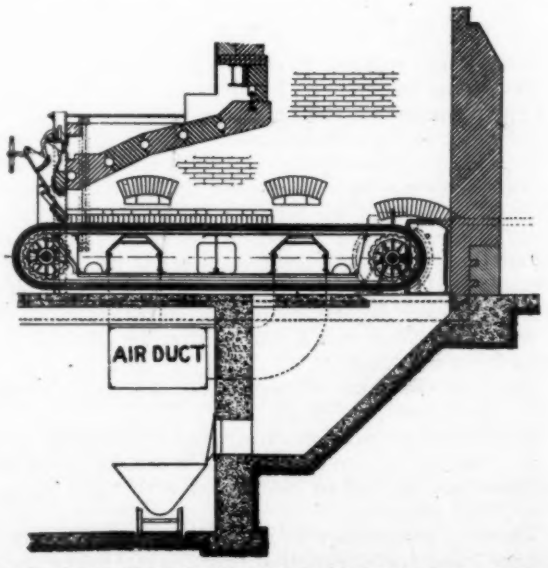


Fig. 2.—Coxe Chain-Grate Stoker, Showing Arch, Furnace Chamber, Ash Pit, Etc.

been largely overcome in recent models, by the use of some such device as the bridge-wall water-box and suitable dampers. A distinct advantage of chain grates over other types is that they can be withdrawn from the furnace for inspection or repairs, without interfering in any way with the boiler setting.

Chain-grate stokers in general produce less smoke than other overfeed or underfeed types, due to the fact that there are no cleaning periods necessary. Such periods occur with the latter types of stokers at intervals depending upon the character of the fuel used and the rate of combustion. With chain-grate stokers, the cleaning is continuous and automatic, and no periods occur when smoke will necessarily be produced.

This class of stoker is particularly successful in burning low grades of coal, running high in ash and volatile matter, which can only be burned with difficulty on the other types.

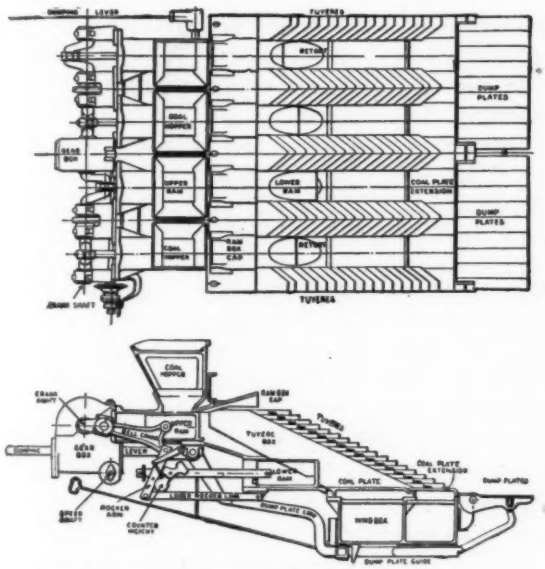


Fig. 3.—Two Views of Taylor Underfeed Stoker.

The standard type of chain grate is not adapted to coking coals, on account of the swelling action of the fuel under the ignition arch. The chain grate may be modified to burn this class of fuel by introducing inclined coking plates immediately under the front of the distillation. This agitation prevents the coal from fusing together and by the time the fuel reaches the grate proper it no longer tends to cake.

Individual Chain Grate Stokers.

The general characteristics of chain-grate stokers have already been described. It may be of interest, however, to set down the individual characteristics of a representative number of chain grate stokers. It should be understood, of course, that the fact that a particular stoker is mentioned by name, does not mean that the use of that stoker is recommended in preference to some other which is not mentioned.

Babcock & Wilcox Chain-Grate Stoker.

Coals Best Adapted For—Bituminous high volatile.
Draft—Natural or forced.
Arch Construction—Parallel to grate, extending over two-thirds or more of grate surface.
Constructural Features—Bridge-wall fitted with water-back to prevent grate bars from being burned. Construction excludes air at side of stoker. Structural channels between upper and lower layers of chain at rear of grate, form a number of air baffles. Arrangement is such that a varying amount of air may be admitted to the rear of stoker to meet varying conditions of combustion. Any in-leakage of air at rear prevented by bridge-wall water-box, connected to circulation of boiler.
Operational Features—With normal uniform load, the type of ignition arch and setting insure smokeless combustion, but careful manipulation is necessary with rapidly fluctuating loads to prevent the formation of smoke.

Illinois Chain-Grate Stoker.

Coals Best Adapted For—Illinois, Kansas, Iowa, Ohio, Arkansas and other Middle West coals, running 10 to 25 per cent ash.
Draft—Natural or forced. Draft should be about .6 in. for high ash and .4 in. for low ash coals. At these drafts, the stoker will average 42 lb. of coal per sq. ft. of grate surface.
Arch Construction—Flat suspended.
Constructural Features—Hand-operated dampers, built into place between upper and lower traveling links, permits cutting off active chain grate surface. Arrangement permits use of a "short fire" at light loads, without excessive air leakage.
Operational Features—Fuel bed depth 5 to 6 in. Rate of combustion varies proportionately to square foot of draft over fire.

Green Chain-Grate Stoker.

Coals Best Adapted For—Type "K" is built for long-flaming bituminous. Type "L" for coking bituminous coals.
Draft—Type "K" uses natural draft. Type "L" either natural or forced.
Arch Construction—Is ventilated flat suspended type.
Constructional Features—Air in-leakage between chain and side walls prevented by adjustable flanges. In type "L" an inclined moving apron is provided to coke the fuel before it passes out onto the chain. A stationary water-back at times is used on bridge-wall.
Operational Features—Approximately 10 lb. of coal per sq. ft. of grate surface can be burned for each .1 in. draft available over fire. .6 in. draft required to burn 50 lb. per sq. ft. of grate surface per hour on type "K".

Playford Chain-Grate Stoker.

Coals Best Adapted For—Free burning bituminous.
Draft—Natural. .15 to .2 in. over fire for normal loads. .2 to .4 in. for loads up to 200%.
Arch Construction—Ventilated air-cooled flat type.
Constructional Feature—Air in-leakage in rear prevented by either fixed or movable water-back, or in some types of construction, by a special air-cooled movable back. Stress laid by manufacturers on movable feature, on ground that it permits holding fuel bed on the grate, until entirely consumed.

Laclede-Christy Chain-Grate Stoker.

Coals Best Adapted For—Illinois, Middle Western bituminous; also Eastern long-flaming coals.
Draft—Natural.
Arch Construction—Flat suspended type.
Constructional Feature—Air in-leakage at front and sides prevented by fuel gate being set against ignition arch and side frame construction, using ledge tile composed of special abrasive refractory. Leakage at rear, prevented by baffles between upper and lower chain. Bridge-wall overhangs grate.
Operational Features—Best fuel-bed depth 5 to 6 in. Overloads up to 250% not uncommon, but require high draft.

Westinghouse Chain-Grate Stoker.

Coals Best Adapted For—Long-flaming bituminous.
Draft—Natural. Minimum .15 in.; maximum .6 in.
Arch Construction—Flat suspended.
Constructional Feature—Air in-leakage in front and rear, prevented by arrangement of frames and baffles.
Operational Feature—Combustion rates up to 50 lb. of coal per sq. ft. of grate surface can be obtained.

Coxe Traveling Grate.

Coals Best Adapted For—Anthracite and anthracite-rice.
Draft—Forced only.
Arch Construction—Upward inclination toward rear.
Operational Feature—175 to 200% load can be carried with 3-in. pressure in the ash-pit.

Editorial Comment

Notice to Subscribers.

As a part of the War Revenue Bill, Congress enacted the Zone Postal Law. Obviously this discriminates against the periodical subscriber who is unfortunate enough to live a long distance from the city where his magazine is published.

The first increase in Zone Rates for the past year has been borne by the publisher.

In putting the second rates into effect, the Publishers of Electrical Review will, starting July 1, add to the subscription price the exact amount of increase in postage, figured by zones.

Electric Fan Service

HOT weather has by this time made its appearance in practically all parts of the country and this means, of course, that the electric fan season is in full swing. On past occasions we have repeatedly pointed out that while this is and will remain *the* fan season in the sense of being the period of greatest sale and use, it is also the period of greatest opportunity in educating the public how to get the most effective use out of the fan and that the fan is capable of utilization for many other purposes and should be kept available for these after the hot spell has passed. In other words, the dealer, jobber, manufacturer and central station can each help in rendering this greater fan service. Intelligent action along this line means appreciation by the public which results in more fans sold, more fans used in the summer and more fans used throughout the year.

Chicago's Co-operative Sales Campaign

CHICAGO'S electrical industries seem to have grasped the co-operation idea at last and with the true "I Will" spirit are rapidly forging ahead of many localities that boast of having adopted this spirit long ago. This is evidenced by the appliance sale campaign which was started in that city during the past week and for which every branch of the electrical industry is in some measure responsible.

Although this is not the largest or most comprehensive campaign ever attempted by the combined efforts of the industry, nor the first to feature a part-payment plan it is the largest to our knowledge that has ever been attempted through the co-operation of the manufacturers, jobbers, central-station company and the local dealers, without outside influence, which also includes this installment feature as part of the campaign. For this reason the companies and associations and their officials who developed the idea should be commended for their work in this respect and the spirit which prompted them, and it is to be hoped that the plan will enjoy the success which it deserves.

Tunnels for Electric Cables

TUNNELS for electric cables may be built for any one of several reasons. One reason may be that subterranean congestion necessitates this form of routing cables. Another reason may be that the large number of cables makes the tunnel more convenient than lines of ducts. A third reason is where the tunnel is less expensive than any other method.

Chicago is divided up by a river that winds through it. Cables crossing this river could be placed underground or could be laid in the bed of the river. The other alternative would be to encompass the river which would necessitate making long detours. Elsewhere in this issue Mr. Springer points out why the construction of tunnels is superior to the cable laid in the river bed; and he shows the economy in investment of the direct tunnel over the duct lines that must make a long detour. The manner in which the Commonwealth Edison Co.'s tunnels were constructed is also described in an interesting manner, some of the difficulties experienced and the manner of overcoming them being reviewed.

Need for Sober Thought

SOBRIETY in thought is now as necessary to be cultivated as sobriety in the partaking of liquid refreshment. Within ten days the law will attempt to enforce the latter, but no law can readily enforce sober and sane thought and speech. The momentous questions of permanent international peace, a league of nations, feeding of famished nations, reconstruction of war-devastated districts, readjustment of international and domestic trade to peace conditions, settlement of the social and economic unrest, and other important topics of the day cannot be taken care of properly and in an enduring manner unless we all make up our minds to seek the actual facts before formulating a solution. The appeal to the emotions or prejudices is usually accompanied by distortion of the truth, if not an entire absence of truth. It leads to snap judgment and is characteristic of the professional agitator.

We have no fear of the truth and honest appeals to the intelligence of the public. In the light of all the facts we also have no sympathy with the pessimists who see nothing but business and general social ruin

if not the end of the world ahead. Let the sober-thinking individuals assert themselves and we shall have a more progressive electrical industry, better business conditions, more widespread prosperity, much less poverty and suffering and in general a more wholesome world to live in.

Isolated Plant Costs

ISOLATED plant costs as affected by the war are a matter of paramount importance to the many thousands of isolated power plant managers and engineers throughout the country because, while the war is won, the effect of the war upon the price of commodities remains. Likewise the cost of operating isolated power plants is of vital concern to the central stations, because the problems of the one are the problems of the other to a very great extent. And then circumstances not favorable to the isolated plant may favor the central station replacing it; and the possibility of being able to furnish such service depends not upon the actual cost but upon the saving in many ways.

The article on "The Effect of the War Upon Isolated Plant Costs" appearing elsewhere in this issue is worthy of careful study by all concerned with the operation of the isolated plant or in replacing the isolated plant by central-station service. This article contains a large amount of valuable data obtainable only after considerable work on the part of the compilers. And then, interpreting the results is itself a tedious task. The investigation reviewed in the above article was made by the Isolated Plant Committee of the National Electric Light Association at the suggestion of the chairman of the Commercial Section, Mr. C. J. Russell, manager sales department, Philadelphia Electric Co.

The eastern states suffered more acutely from coal shortage and from intensive industrial activity than did the middle western states and the problem of taking over isolated plants became a very real one. To what extent the isolated plants can continue to be won over to central-station service, entirely or for certain seasons or periods of the day, depends upon the relative costs of the two classes of service. The power engineer and the utility management fortified with data as to the cost of operating the isolated plant, and armed with a knowledge of the cost of utility supply, is well prepared to win over the isolated plant to central-station lines. The article referred to may not apply in detail other than around Philadelphia. On the other hand, the reasoning is sound and the manner of determining operating costs can be followed in similar surveys made elsewhere.

The management of isolated plants may well study this article on "The Effect of the War Upon Isolated Plant Costs." All plants have not been affected alike by the war or by conditions as they exist since the war. But all have felt, and are still feeling, the high costs of fuels and of labor. Prices have not avalanched downward, except in exceptional and rare instances. In fact there is every indication that the price of coal will continue to remain high; cheap coal may never come again. The purchase of central-station service brings with it a number of intangible things that, while difficult if not impossible to capitalize, are none the less real; and these should be thrown in for "good measure" when estimating the relative costs of service for the utility and the isolated plant.

Let the Public Know Utility Facts

WE HAVE repeatedly called attention to the fact that public utility service is of deep concern to the public and that therefore all important facts bearing on it should be known to the public. It is generally conceded by those who have studied the public relations of the utility companies that these would be much more congenial if the public had at least a reasonably fair understanding of utility problems. Probably at no time have these problems been more serious, this being due principally to the difficulty of making the income equal the heavy expenditures due to greatly increased costs of labor, fuel and other necessities. The public must be made aware of these facts, because if they were understood the problems involved would quickly disappear since the public in general is fair-minded and eager to give justice to all concerned.

The policy of publicity has been heartily commended by Mr. R. H. Ballard, president-elect of the National Electric Light Association. As stated in our interview with him in the last issue, he believes that the rendering of high-grade service is the first essential. If such service is supplied, the public is put into a more favorable frame of mind toward receiving the candid facts on the cost of such service and other necessary conditions involved. It will not be content with inferior service and in order to secure the service it desires it will readily see that a fair charge is made so that the income is sufficient.

Other prominent utility operators of extended and varied experience who see the wisdom of utility publicity are Messrs. Samuel Insull, Henry L. Doherty and H. M. Byllesby. Each of these well-known central-station men has felt that fair treatment from the public cannot be expected if the latter is kept in ignorance of the true facts, especially when rate questions are up for reconsideration, as is generally the case just now in many communities.

In Illinois this problem has become so acute that the Illinois Committee on Public Utility Information was formed, as noted in recent issues, to serve as a publicity bureau. At a meeting last week its work was endorsed as being specially urgent because the utilities of the state will need some $450,000,000 of new capital within the next five years for extensions and betterments. Every effort should therefore be turned to presenting the actual facts about utility serv-

ice. Let the public know the facts so that its policy will be based on intelligence and not on prejudices inspired by notoriety-seeking politicians or social-revolutionary radicals.

Enclosing of Exposed Live Contacts

SOME of the changes in the new Chicago Electrical Code which are published elsewhere in the issue may at first appear to be radical or even arbitrary. This is especially true of that change which requires the enclosing of all exposed live and arcing contacts for these have been permitted without protection for so long that their installation in this manner is seldom questioned. However, that does not lessen their danger as a fire or life hazard and the adopting of this rule simply marks another step by the code authorities toward safer and better electrical work and apparatus and should be accepted as such by the industry.

The striking changes referred to above will apply to new installations and those of manifest hazard after the first of next year. They have been incorporated in the Chicago Code because numerous investigations of electrical accidents and of fires alleged to be due to electrical causes led to the certain conclusion that serious hazards result from exposed live contacts of motors, switches and other apparatus and appliances. The municipal electrical authorities are legally obligated to make such investigations of electrical accidents and fires and are under moral obligation to point out, if not insist on, a remedy. The new rule is the solution they recommend.

It is interesting to observe that the same remedy is being proposed by safety authorities as well as by fire and accident hazard experts in general. For instance, decided progress has been made in the extension of the rule requiring enclosed safety switches in mills, factories and other industrial plants, it having been found that numerous accidents resulted to machine operators uninformed on electrical matters who had occasion to start and stop motors by means of ordinary open knife switches. The result has been enactment of the enclosed switch rule in several states and many cities, to which Chicago is now added. This rule has stimulated the development of properly constructed safety switches and has been the means of reducing accidents from switches very materially.

In adopting the rules prohibiting exposed live contacts and conducting parts far in advance of their incorporation in the National Electrical Code, the Chicago Bureau of Electrical Inspection is carrying out its practice of following the National Code in general but leading it where additional safeguards against fire and life hazards are necessitated by the conditions existing in a very large city. Thus Chicago was one of the first cities, if not actually the first, that insisted on all metal conduit and raceway construction and prohibited the use of knob and tube wiring and use of wood molding.

The tendency of the times is undoubtedly toward making electrical circuits and apparatus entirely safe and foolproof. This makes really for still more extended use thereof. The rules to bring this about can be introduced from time to time without hurting the industry—actually they should benefit it.

Increasing the Use of Automatic Substations

AUTOMATIC substations find their greatest justification where the load is comparatively light, hence attendants are not justified for supervision, and where the load goes on and goes off in such a way that it can be taken care of without attendants. One class of the automatic substation that has made quite rapid headway—although not the headway that one might reasonably have expected—is that of the railway substation located along the interurban trolley line. Here the traffic requires that machines be located at certain distances along the line and that they be operated only while trains are in proximity. For such service the automatic substation is ideal, being economical of labor and energy. It is understood that there are 37 of these automatic substations in service, in capacities ranging from 300 to 1000 kw.

Another class of automatic substation that one might expect to grow in numbers is that such as one finds located in the basements of hotels, department stores and office buildings obtaining their light and power from direct-current networks. The electrical apparatus in these buildings may operate continuously or only during the peak load locally and it is for this latter service that the automatic proves so useful.

The semi-automatic substation is a type of substation that finds application where an entirely automatic substation is not applicable, either because of the initial financial outlay involved or because of the characteristics of the load served. One instance where the semi-automatic substation is deserving of careful consideration is in those instances where the automatic substation would only be permissible for a year or so because of rapidly increasing load. Here the initial cost of the automatic substation may be largely saved by employing the semi-automatic substation, thereby obtaining a saving of labor at the commencement without having to charge off the heavier investment of the entirely automatic substation as the load grew.

The question of the automatic and the semi-automatic substation is one of ultimate cost. The higher cost of automatic equipment must be balanced against the cost of attendance. And there is the matter of reliability to be taken into consideration also for a few applications, although experience so far shows that the automatic substation is entirely reliable. In cases where changing conditions hardly warrant the installation of automatic apparatus, the semi-automatic substation with its starting and stopping, reclosing features, etc., is deserving of consideration.

Week's Events

New Officers of I. E. S.—Plans for Chicago Electrical Show Progress Favorably—Meetings of Electrical Manufacturers

IMPORTANT MEETINGS HELD BY ELECTRICAL MANUFACTURERS.

Two General Meetings Held by Associated Manufacturers of Electrical Supplies—Twenty-five of Its Sections Also Hold Meetings at New London.

One of the most important gatherings of the Associated Manufacturers of Electrical Supplies was attended by over 200 of its members on Monday to Wednesday, June 16-18, of this week. The headquarters of the association were at the Hotel Griswold, Eastern Point, New London, Conn. Two general sessions were held on Monday and Tuesday evenings, each presided over by President A. W. Berresford, with Charles E. Dustin general secretary. The first of these sessions was devoted to a general discussion of the need of tariff revision, this being led by William Burmesa, who explained the needs of electrical manufacturers in this regard. The report of the International Trade Committee covered the subject in a comprehensive manner. Prompt action was decided upon through the Industrial Conference Committee. At the general session on Tuesday evening, C. E. Eveleth, of the General Electric Co., presented a very interesting address on the submarine detector and the part it played in the fight on the German U-boats. This device was described in ELECTRICAL REVIEW, March 29, 1919. This session was very largely attended.

The numerous sections of the organization held sessions throughout the three days at which were discussed the problems affecting their respective special interests. Nearly all the sections re-elected their former officers. The Fuse Section held one of the most important meetings. It discussed and adopted a standard for the renewable type of cartridge fuses under which manufacturers may operate with the approval of Underwriters' Laboratories. This section elected R. C. Buell, chairman; C. A. Bates, secretary, and F. V. Burton, treasurer. The Molded and Formed Insulation Section elected Joseph Rockhill, chairman; A. D. Appleton, secretary, and B. H. Howell, treasurer.

The Board of Governors of the association held one meeting devoted chiefly to confirmation of routine matters. It adjourned to meet in September. Throughout the three-day meeting of the organization there was shown a fine, earnest determination to work out the problems of the industry and face the future with a spirit of optimism.

ANNUAL MEETING OF NATIONAL ELECTRICAL CREDIT ASSOCIATION.

Delegates from the Five Local Associations Discuss Their Problems at Cincinnati National Meeting.

As briefly noted in our last issue, the 20th annual meeting of the National Electrical Credit Association was held at Cincinnati, June 13 and 14. The meeting was opened by President Charles C. Hillis, San Francisco, by welcoming the delegates who came mostly from the eastern, southern and central states. A brief report was presented by each of the members on the National Board of Managers representing the Electrical Credit Associations of Boston, New York, Philadelphia, Chicago and San Francisco. the activities of which cover the entire country.

The general secretary's summary showed a total membership of 577 of the representative electrical manufacturers and jobbers. There had been a slight falling off in membership as compared with the previous year, due to consolidations largely of concerns and changes in business of members owing to war conditions.

The total number of names of slow or otherwise unsatisfactory customers reported to the five associations was 167,758. Both in number and in amount involved there was a decrease on an average of 30% as compared with the preceding year, and of more than 50% as compared with the totals of 1915. These figures and percentages reflect the general satisfactory condition of outstanding accounts and bills receivable due the electrical manufacturers and jobbers. It was conceded that the activities of the five local associations composing the national body, had served in such timely fashion for the members generally as to guide them against extending credit to irresponsible or unsatisfactory customers and thus save them from preventable losses. The showing, therefore, was regarded as a splendid evidence of the effectiveness of the service of the association.

To accomplish these results, however, cost more money than was heretofore expended, due to advances in price of printing the national monthly bulletin, *The Viewpoint*, the monthly journal of service information, and in supplies and sundry expenses. In recognition of which, the National Board voted to increase the per capita dues levied by the National Association upon the five local associations, effective November 1, 1919, to insure a safe margin in the financial budget upon which to conduct the service.

It was provided further that the names of municipalities defaulting in the payment of their indebtedness, warrants, etc., to members, should appear in a special department of the national monthly bulletin for the credit guidance and protection of the membership at large.

The most important single report presented was that by George J. Murphy, Pettingell-Andrews Co., Boston, chairman of the Committee on Standard Accounting System for Contractors and Dealers in the electrical industry. The work of Mr. Murphy and his committee received the unanimous and hearty endorsement of all members present and it was urged that each should study the 12-page pamphlet issued by the National Association of Contractors and Dealers embodying the work of the committee, and that the system be adopted by the contractor and dealer

customers of the manufacturers and jobbers composing the National Electrical Credit Association.

The addresses of the convention were admirable. Particularly notable was the address of W. C. Culkins, director of street railways of Cincinnati, who took as his subject "Public Utilities" and showed the absolute necessity for a better understanding of the problems of public utilities by the citizens at large and enlightened and unprejudiced treatment of the utilities by the several state commissions. The address of R. A. Tingle, president of the Cincinnati Rotary Club, on Americanization was listened to with marked approval. For clarity of expression on a now somewhat hackneyed subject, the palm was accorded to Charles W. Dupuis, Citizens National Bank of Cincinnati, on trade acceptance experiences.

Among the subjects of general interest treated by the members attending was the address of T. K. Quinn, National Lamp Works, Cleveland, on consignment credits and lamp agents. The value of the National monthly bulletin and the systematic use of forms was discussed by William R. Conklin, Waclark Wire Co., of Elizabeth, N. J. V. G. Fullman, Steel City Electric Co., Pittsburgh, spoke informally on credit interchange luncheon clubs. The other subjects presented in our notice of the meeting published last week were ably handled by the speakers assigned. The impressions gleaned from the 24th annual convention of the National Association of Credit Men the same week at Detroit, and presented by E. W. Shepard, general credit manager Western Electric Co., New York, constituted a splendid summary of the helpful points brought out at the Detroit Meeting.

Among the social features of the meeting was a delightful afternoon and evening spent at the Fort Mitchell Country Club in Kentucky, in which golf and tennis were indulged in by visiting members, topped with a delightful dinner, good speeches, and much lusty singing splendidly led by Will R. Reeves, of Cincinnati. The wives and lady members had meantime enjoyed automobile rides to points of interest in Cincinnati and environs.

The election of officers resulted as follows:

President—Benjamin P. George, Beardslee Chandelier Manufacturing Co., Chicago.

Vice-president—George J. Murphy, Pettingell-Andrews Co., Boston.

General secretary-treasurer—Frederic P. Vose, Chicago.

Assistant secretary-treasurer—Walter S. Vose, Chicago.

PLANS FOR CHICAGO ELECTRICAL SHOW PROGRESSING FAVORABLY.

Representative Manufacturers to Exhibit New Electrical Developments at the Chicago Show This Fall—Novel Lighting Effects.

As announced in our issue of May 3, 1919, the first electrical show which Chicago has seen for eight years will be held this fall at the Coliseum, Oct. 11 to 25, inclusive, and according to plans being formulated by Manager E. W. Lloyd, will be one of the largest trade shows of the kind ever held.

There have been so many and such diversified developments in the electrical field during the past few years that this show will offer to the visitor an unusual opportunity to view them all under one roof.

For instance, the National Lamp Works will show for the first time a new type of electric lamp and other important lamp developments, with all of which electric light users should familiarize themselves.

The housewife will see in operation compact, convenient electric ovens which attach to any lighting socket and which are not equalled for baking biscuits, cake, etc. Electric grills will be displayed upon which an entire meal may be cooked. Small motors which do all kinds of housework—sewing, polishing, cleaning, turning ice-cream freezers, etc.—will be demonstrated.

Contracts for considerable of the space have been made with exhibitors in almost every branch of the electrical industry, including manufacturers, jobbers, retailers, contractors and central-station companies. Electric welding, electric refrigeration, new type electric ranges, daylight lighting effects, ironing machines, electric signs, electric ventilating apparatus, industrial heating, electric trucks and passenger vehicles will all have a graphic practical showing.

An elaborate system of lighting will be installed in the Coliseum for this after-the-war electrical exposition, emphasizing the effect of modern artificial illumination for beautifying interior decorations.

The Electrical Trades Exposition Co., composed of men prominent in the electrical industry of Chicago, put on all of the previous Chicago electrical shows and claims that this 1919 exposition will far outdo the others in every way. The office of its manager, E. W. Lloyd, is at 72 West Adams street, Chicago.

PUBLICITY CAMPAIGN OF ILLINOIS UTILITY COMPANIES.

Combine in Co-ordinated Effort to Place Before the Public Their Most Urgent Problems.

Public utility managers and operators of Illinois held a meeting in Springfield, Ill., on June 13 and laid plans for closer co-ordination of effort in placing the after-the-war case of the industry, as a whole, before the public. To bring about a better understanding of the situation which the electric, telephone, gas and street-railway companies face, in common with all other lines of business due to high cost of materials and labor, managers of all utility companies operating in the various towns and cities of Illinois are to organize to unify their efforts. Acting through the Illinois Committee on Public Utility Information, which is operating under the auspices of the Illinois Electric Association, Illinois Electric Railway Association, Illinois Gas Association, the telephone organizations and other utility organizations and companies, a program is to be carried on fully to inform the citizens of the state as to the situation of the industry.

It was pointed out at the meeting that unless the billion dollar investment of the utility industry is fairly treated and a better understanding of its position brought about, much injury can be wrought, and the services rendered by these companies disrupted. Speakers at the meeting declared that the ramifications of the industry in the state are such that 33⅓% of all citizens, directly or indirectly, now have a financial interest in the companies, either as wage earners, security holders or through collateral industries dependent upon the utilities. Of the total of all citizens, 16% are in the employ of the electric, gas, telephone, water, street and interurban railroads, and similar utility companies. It was particularly insisted that a better understanding be created because of the need of investment of $450,000,000 of additional capital in

the state within the coming five years in order to meet the growing demands for line extensions, plant betterments, etc.

NEW OFFICERS OF ILLUMINATING ENGINEERING SOCIETY.

Announcement of Letter-Ballot Election of National Officers and Section Officers.

At the meeting of the Council of the Illuminating Engineering Society held on June 12 the recent letter-ballot election of officers was canvassed, the result confirmed by the Council and announced as follows:

President, S. E. Doane, chief engineer, National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.

Vice-president, Wm. J. Clark, New York City.

General secretary, Clarence L. Law, New York City.

Treasurer, L. B. Marks, New York City.

Directors, E. C. Crittenden, F. E. Cady and R. B. Ely.

The foregoing, together with the following hold-over officers, will constitute the Council for the fiscal year beginning Oct. 1, 1919:

George H. Stickney and George A. Hoadley, past-presidents; H. A. Hornor, Otis L. Johnson and H. K. Morrison, vice-presidents; Adolph Hertz, S. C. Rogers, P. S. Young, John C. D. Clarke, Evan J. Edwards, James J. Kirk, directors.

The election of section officers was also confirmed as follows:

New York Section.—Chairman, F. M. Feiker; secretary, R. E. Harrington; managers, W. T. Blackwell, W. J. Clark, L. J. Lewinson, J. P. Radcliffe, Jr., G. A. Sawin.

New England Section.—Chairman, H. F. Wallace; secretary, H. W. Jordan; managers, G. N. Chamberlin, John C. D. Clark, J. W. Cowles, Raymond A. Fancy, F. A. Gallagher, Jr.

Philadelphia Section.—Chairman, G. Bertram Regar; secretary, H. B. Andersen; managers, H. Calvert, C. E. Clewell, R. B. Duncan, Howard Lyon, W. L. Nodell.

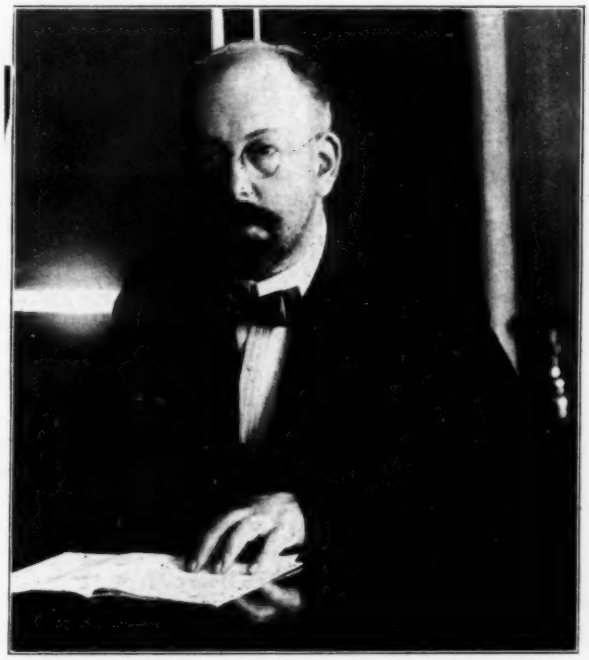
Chicago Section.—Chairman, F. H. Bernhard; secretary, E. D. Tillson; managers, A. L. Arenberg, F. F. Fowle, E. H. Freeman, Jas. J. Kirk, J. L. Stair.

The President-Elect.

Samuel Everett Doane, the president-elect, has been actively associated with the incandescent lamp industry for some thirty years and is probably the best known authority on this subject. He was born at Swampscott, Mass., Feb. 28, 1870, attended the schools of that city and was graduated from the High School in June, 1886.

Entering the Lynn, Mass., works of the old Thomson-Houston Co. as office boy, he applied himself diligently to the study of electrical science and engineering and worked four nights a week on the testing force or in the laboratory so that within six years he rose to the position of acting engineer and assistant foreman of the incandescent lamp department. In 1892 the Lynn lamp department was shut down because of the financial panic and all the employes were released with the exception of Mr. Doane, who was transferred to the Harrison, N. J., works of the General Electric Co., which had been formed by the consolidation of the Thomson-Houston and Edison companies. He was assistant engineer of the Harrison lamp works for about a year, then superintendent until 1894, when he was made acting engineer of the foreign department at the Schenectady, N. Y., head office. In 1897 he left the company to become superintendent of the Bryan-Marsh Co.'s lamp factory at Marlboro, Mass., remaining till the formation in 1900 of the National Electric Lamp Association with headquarters in Cleveland, Ohio.

This organization was formed by a large number of manufacturers of incandescent lamps for co-operative development work, chiefly through an engineering department at whose head was placed Mr. Doane as chief engineer, which position he retained during the change of the organization some years later to the National Lamp Works of General Electric Co. and has held continuously to the present. Mr. Doane is responsible for many important improvements in lamp manufacture and developments in new and more effective utilization of lamps. He has given much thought to making modern artificial lighting available



S. E. Doane, President-Elect of the Illuminating Engineering Society, at Work in His Nela Park Office.

in even the most modest homes. Much study was given by him to the subject of central-station rates for lighting and power service, to standardization of voltages and other important matters that are by no means all confined to electrical science and art. Mr. Doane has a very pleasing personality that accounts partly for his very large circle of friends. He is a member of and has been active in the Illuminating Engineering Society, National Electric Light Association, American Institute of Electrical Engineers, and a great many other engineering, scientific and civic organizations.

CHICAGO MEETING OF MINING AND METALLURGICAL ENGINEERS.

Plans for Technical Sessions and Inspection Trips Covering Week of Sept. 22-27.

Plans for the meeting of the American Institute of Mining and Metallurgical Engineers to be held at Chicago next September are assuming definite form

and the committee in charge announces the following schedule of events.

On Monday, Sept. 22, the opening day, the morning will be devoted to registration of members and guests at the convention headquarters, the Congress Hotel. Monday afternoon the first session for presentation and discussion of technical papers will be held, and in the evening a smoker.

It is planned on Tuesday to make an excursion in a body, by a boat chartered for the occasion, across the south end of Lake Michigan to Gary, Ind., for a trip through the famous steel mills.

Wednesday will be devoted to technical session, morning and afternoon, and in the evening the banquet will be held at the Congress Hotel, at which all members of the Institute and their wives will be the guests of Chicago.

On Thursday a special train will convey the members and guests to La Salle and Depue, Ill., where the zinc smelteries, coal mines and cement works will be visited. For those to whom these industrial operations are not of particular interest—this may include many of the ladies—there will be a trip by automobile to Starved Rock and other points of historical interest in the vicinity of La Salle.

For Friday several optional excursions have been planned to local industrial plants. One trip will take in the lead refineries of East Chicago and the Standard Oil refinery at Whiting, Ind. Another excursion will be to Milwaukee, to the plants of the Allis-Chalmers Manufacturing Co. and the Power & Mining Machinery Co.; this trip will also include the metallurgical works at North Chicago of the Pfanstiehl Products Co. where novel electrothermal processes in the production of metallic tungsten, molybdenum, cerium and tantalum will be demonstrated.

For those interested in coal mining it is planned to have an excursion to the fields in Franklin and McCoupin counties, Ill., leaving Chicago late Friday evening and spending Saturday at the mines.

TRIALS AND ACHIEVEMENTS OF MILITARY ENGINEERING.

Pittsburgh Section, A. I. E. E., Gives Dinner to Lieut.-Col. Schoepf and Hears of His Experiences in France.

The Pittsburgh Section, American Institute of Electrical Engineers, gave a dinner on June 7, at the University Club, Pittsburgh, to Lieut.-Col. Theodore H. Schoepf, of the 15th Engineers U. S. A., who is a former chairman of the section. Previous to his entrance into the service, Colonel Schoepf was general engineer of the Westinghouse Electric & Manufacturing Co., and is now assistant to the president of the Cincinnati (Ohio) Traction Co. After dinner, the guest gave a most intimate account of some of his engineering experiences encountered during his stay of nearly two years in France.

He was commissioned as captain in May, 1917, went across in July of that year, and was promoted to major and subsequently to lieutenant-colonel the following year. The first work assigned to him was to build a refrigerating plant to make 500 tons of ice per day and care for 5000 tons of meat a week, to be 150 by 900 ft. in size and in three compartments. The location was near Gievres, a barren waste 6½ miles long and a half mile wide. The order as given by Colonel Jadwyn was, "Captain, put up an ice plant that will keep an army of a million men in fresh beef." "I looked at him and looked at the desert," said Colonel Schoepf, "'Where do I get the material?' He seemed very much surprised at such a question and simply said, 'Oh, go and get it.' So I went out in the woods, cut down some trees, stole some sheet iron for a roof from the aviation section, requisitioned tools and materials, and began operations. The only tools we had were some cast-iron hammers from the French, which would break into pieces if you hit a 10-penny nail with them. The first material received, though obviously the last that was needed, was 50 car loads of shavings to be used as heat insulation in the plant walls. A building had to be erected to store these and protect them from the weather. Cement and gravel and other materials had to be brought a distance of from 40 to 50 miles. The Government furnished a large number of so-called refrigerating experts, but the only line in which they proved themselves expert, was in mixing drinks. They were utterly incompetent, but the plant was finished on schedule time in spite of all the obstacles.

The plant, including a large number of warehouses and storehouses, comprised 600 miles of track and 240 buildings with dimensions of from 50 by 200 to 240 by 500 ft. The depot was never completed, and was entirely too large for service, as it involved too much trucking after unloading the materials.

One of the first consignments was a lot of 200 polished oak coffins, presumably for generals, and a house had to be built to store them. Next came a lot of boxes and containers for returning material after the war, all of which had to have shelter.

Speaking of labor conditions, Colonel Schoepf said he had a force of 4300 men, of whom 1200 were Chinamen, 600 from the north, and 600 from the south of China. These could not be worked together or a war would ensue at once. Others were Arabs, Turks and Greeks, none of whom could be worked with each other, nor with the Chinamen for the same reason.

Considerable railroad building was done by Colonel Schoepf, including the construction of one road at the rate of three miles of track a day with 180 men, while exposed to shell fire and bombing from airplanes. Shell fire, he said, soon loses its terror, as one easily learns to determine the location of the shells, but bombing is a constant source of terror, and they received little help from our aviators. American rails were in abundance, but no spikes were available so screw spikes had to be used.

An interesting example of American spirit and aggressiveness was exemplified by Colonel Schoepf as he modestly told of building a railroad between Verdun and Sedan, to carry provisions to the American and Allied Armies. On being asked when he could have such a road completed, Colonel Schoepf said he would have a ration train running over it into Sedan by the first of the year. The French laughed and said maybe it could be done by August 1. But the building of the road was a terrific task. The territory is indescribable in its desolation, one cannot step 10 ft. in any direction without getting into a shell-hole; the gas had destroyed every living piece of vegetation and even the soil smells rotten; the only green to be seen is on the newly made graves of soldiers. When the Germans retired the demolition of the road was most complete, they had dynamited the right of way beyond description, bent and twisted every rail, blown up the culverts and made shell-holes every few feet. In spite of these obstacles, the first train went into Sedan on Dec. 31.

This was only accomplished, however, by the won-

derful spirit of the men to whom the greatest possible credit is due. Day after day they toiled, Christmas day included, often in water up to their waists, and this was all done on poor rations, because the engineers were army troops, working directly under the chief engineer of the First Army and not attached to any division, and consequently had no one to look after them. This work was also expedited, said the speaker, by an interpreter who could swear in French.

The officers who entered the army from civil life, said Colonel Schoepf, took with them that spirit which enabled it to do what it did; they made mistakes, lots of them, but they were willing to admit them, whereas a regular army officer rarely, if ever, admits making a mistake. The speaker said that he had at one time had hopes of following military engineering as a profession, but his brief experience in actual warfare had led him to give up this idea because of the lack of breadth of ideas seemingly engendered by service in the regular army.

A brief business meeting was held immediately after the dinner, at which the following officers were elected for the ensuing year: Chairman, J. G. Carroll; secretary, W. L. Schaffer; new members of the Board of Directors—J. R. Buchanan, L. N. Mink, and G. R. Whetstone.

HYDROELECTRIC DEVELOPMENT AT OROVILLE, WASHINGTON.

Dam and First Unit of 5000-hp. Plant Being Installed on Similkameen River.

Plans of further development of hydroelectric power in the vicinity of Oroville, Wash., by the Okanogan Valley Power Co., of Spokane, provide for the construction of a concrete dam across the Similkameen river. The dam, which is now being built, will have a length of 350 ft., a height of 60 ft., and is situated just above a 20-ft. fall of the stream, and will give a head of about 80 ft. at the power house farther down stream. Conduits from the storage pond above the dam to the power plant are to consist of two wood-stave pipes, 8 ft. in diameter and 800 ft. long. The ultimate generating capacity will be 5000 hp., but the one unit to be installed this year will be for 2000 hp. The intention is to generate at 2200 volts, this voltage to be stepped up to 22,000 for transmission. Definite information as to the water turbines and generator is not available at this time.

The company is a producer of electric power at Bridgeport, Mansfield, Riverside, Okanogan, Brewster, Pateros and Omax, Wash. Eugene Enlow is president of the company, with general offices at Spokane.

IMPROVEMENT IN SEATTLE MUNICIPAL ELECTRIC PLANT.

A 10,000-Kw. Water-Wheel Unit and a 10,000-Kw. Steam Turbogenerator to Be Added—Old Machines to Be Rewound.

The plans worked out by the city of Seattle for increasing its electric power production provide for installing 8500 lineal ft. of pipe, 6 ft. in diameter, from Cedar river reservoir to the powerhouse, and the installation of an additional hydroelectric unit at the latter place. The pipe line is to comprise 6700 ft. of wood-stave pipe and 1800 ft. of riveted steel pipe. The steel pipe is required at the lower end of the line where there is a drop of about 400 ft., which will greatly increase the pressure. The total head from the reservoir to the power house is about 600 ft.

The route of the pipe line requires the crossing of a canyon and the plan is to cross on a regular grade over a wood trestle instead of by means of a syphon as was adopted for the old pipe line. The wood and steel pipe will be carried on concrete cradles spaced about 6.6 ft. on centers.

The new unit to be installed at the power station is to consist of a 10,000-kw. water turbine and generator, which will be housed in a new concrete structure adjoining the old building. The plant as it stands today contains two units of 5000 kw. each and two of 1500 kw. each. It is probable that the two 5000-kw. generators will be rewound with mica insulation so as to permit higher operating temperatures, thus increasing their rating to 6000 kw. each.

The proposed increase in capacity of the city's Lake Union steam-electric plant requires the installation of another 10,000-kw. turbogenerator and six additional boilers of 4935 hp. The equipment already in the Lake Union plant consists of two 10,000-kw. units, and 8 Stirling boilers, which are oil-fired.

GOVERNMENT ANNOUNCES POLICY FOR DISPOSING OF SURPLUS LEAD.

War Department Arranges for Disposing of Pig Lead, Lead Pipe, Sheet Lead, Etc.

An informal arrangement has recently been made by C. W. Hare, director of sales of the War Department, with Clinton H. Crane, chairman of the Lead Producers' Committee of the War Industries Board, during the existence of that organization, whereby sufficient orders proffered the lead producers will be allocated by the department to take up, at current market prices, the surplus stock of pig lead acquired by the Government for war purposes. The surplus of pig lead to be disposed of does not exceed 5000 tons. This arrangement assures the department of the maximum return from its surplus, and, at the same time, assists the industry in stabilizing the market.

In addition to the surplus of lead to be disposed of in this manner, there is 21 tons of sheet lead, 10,000 tons of heavy sheet lead, 25 tons of lead pipe and 6 tons of lead slabs, which has been declared surplus and is to be marketed without the assistance of the industry. Consumers interested in this surplus supply, should communicate promptly with the office of Director of Sales, War Department, as an attempt is to be made to market immediately.

The director of sales also announces that he is seeking a market for 1180 tons of antimonial lead and approximately 930 tons of antimonial lead scrap, which the department is willing to dispose of at prices approximating those that obtain for such material in the open market.

FORT WAYNE ELECTRICAL DEALERS DEMONSTRATE ELECTRIC COOKING.

The electrical dealers of Fort Wayne, Ind., have united in a series of lectures and demonstrations of food conservation on electric ranges. The lectures were given by H. Milton Henoch of Pittsburgh, Pa., and were held at the office of the central-station company of Fort Wayne. At the conclusion of the lectures a buffet luncheon was served.

Commercial Practice

Co-operative Appliance Campaign of Electrical Interests—Company Publication Reduces Number of Duplicate Bills

LARGE CO-OPERATIVE APPLIANCE CAMPAIGN LAUNCHED IN CHICAGO.

Commonwealth Edison Co. and 117 Dealers to Participate in Sale—Time Payment Plan Feature.

Perhaps the largest co-operative campaign ever held in one city for the sale of electrical merchandise was launched in Chicago on June 16. This campaign will be conducted by the Commonwealth Edison Co. and more than 100 contractor-dealers located in all parts of the city and will replace the house-to-house summer campaign usually conducted by the former. Considerable assistance and substantial support is also being received from the jobbers and manufacturers of electrical appliances. The appliances to be featured during this campaign, which will last three months, are electric irons, percolators and toasters. During the first part of this period the electric iron will be especially featured.

The campaign is purely a co-operative one in every respect and was developed by the Co-operation Committee of the Chicago contractors and the Commonwealth Edison Co. When the idea was first contemplated it was thought that probably 40 contractor-dealers could be induced to participate but with the help of the jobbers and manufacturers this number has since been increased to 117 and includes nearly every electrical contractor in Chicago who has a suitable place for a salesroom.

The principal feature of the campaign is the time payment plan which has been arranged and which may be used by any of the firms participating in the campaign. It is believed that this is the first time that this feature has ever been attempted in such a broad way. The plan which has been developed is substantially as follows. The retailer upon making the sale will collect the initial payment of $1. The account will then be turned over to the Commonwealth Edison Co. which will collect the balance in six equal monthly payments to be rendered with the customer's electric light bill and payable at any of the company's branch offices throughout the city. The dealer, however, can secure this balance, less a slight interest charge, immediately, by presenting a form which has been prepared for this purpose, to the financing company, the Utilities Finance Co. of Chicago. This form must also be endorsed by an electrical supply jobber. All the money collected from such accounts will be turned over by the Commonwealth Edison Co. to the Utilities Finance Co. direct. Suitable forms have been prepared for all these transactions in order to avoid any complications which might arise.

An intensive advertising campaign will also be conducted in connection with this sale. During this period the Commonwealth Edison Co. will devote a large part of its advertising space in the leading Chicago newspapers to the appliance campaign. These advertisements will include a list of all the dealers participating in the campaign. The list is divided so that the names of the dealers located in the same section of the city are together. The company will also furnish electrotypes of these advertisements to the dealers for use in the smaller newspapers published in the outlying sections of the city. The first of these

Co-operative Newspaper Advertizing Being Done in Chicago in Connection with Appliance Campaign.

advertisements featuring the electric iron is reproduced herewith.

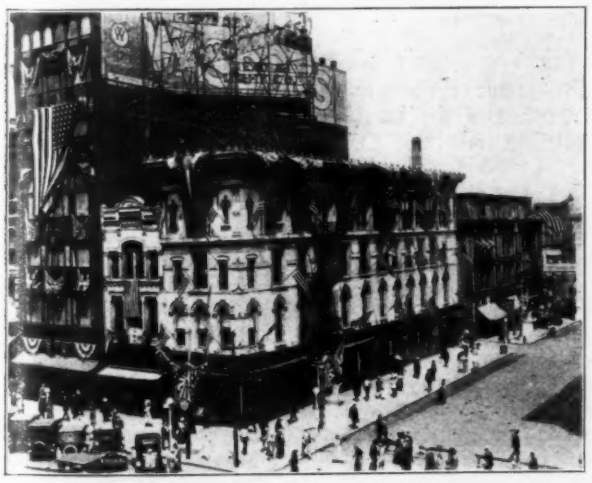
Attractive window displays will also be a prominent feature of this campaign. Large colored posters similar to the newspaper advertisement are being prepared and will be furnished to the dealers for use in their show windows. In addition, considerable assistance is expected from the manufacturers and jobbers in the way of special window designs and decorations. This will be a great help to the dealers as many of them have never before given sufficient attention to their window displays.

The results of this campaign are looked forward to with considerable interest by all branches of the industry for several reasons. This is the first time that such a co-operative effort has ever been attempted by the electrical industry in Chicago and all parties, realizing the bearing it will have on future attempts, here and elsewhere, are striving to make it a grand success both in the total amount of merchandise sold and from the credit standpoint as regards the time payment feature. Furthermore it is expected that it will be the means of inducing many electrical contractors to open retail stores in connection with their contracting business which will greatly increase the sale and use of electrical appliances in Chicago and put the contractor on a much more substantial business basis.

MAKING CENTRAL-STATION HEADQUARTERS ATTRACTIVE DURING CONCLAVE.

Merchants Heat & Light Co., of Indianapolis, Receives Favorable Comment During Conclave of Shriners.

When one of the branches of the Masonic Order holds its periodic national meetings or conclaves the occasion is quite commonly made a civic festival with elaborate decorations, illuminations, concerts, parades, etc. During the week of June 9 the Order of the Mystic Shrine held its national conclave in Indianapolis and this brought a host of Masonic dignitaries and their families to the Indiana metropolis. The central portion of the city was very generally and specially decorated for the occasion.



Headquarters Building of Merchants Heat & Light Co. Decorated for Indianapolis Conclave of Shriners.

Conspicuous in this respect was the building of the Merchants Heat & Light Co., which is located on one of the most important corners in the city. Twenty-one 5-ft. by 8-ft. flags formed the principal feature of the decorations. For persons passing on the sidewalk the decorations in and around the display windows attracted much attention. The large motograph sign on the roof of the building was kept in operation every evening of the week, spelling out its electrical message of greeting to the visiting Shriners. The display made by the company was one of the most important in the city and throughout the conclave formed the subject of very favorable comment.

COMPANY PUBLICATION REDUCES NUMBER OF DUPLICATE BILLS.

Pennsylvania Utilities Co. Realizes Good Results from Folder Sent to Customers.

Considerable difficulty was experienced by the Pennsylvania Utilities Co., of Easton, Pa., recently on account of the large number of duplicate bills that had to be made out at the offices for customers who forgot or lost the bills that had been sent to them. This number had become so large that prompt and rapid waiting on customers was seriously retarded and the efficiency of the billing department greatly reduced.

In order to remedy this the company publication, a four page folder called the *Meter,* was distributed to its customers. As the folder is the exact size of the post-card bill this was easily accomplished by attaching copies to all monthly bills sent out by the company. Comment on this condition in a few issues of the *Meter,* together with suggestions for avoiding it, was sufficient to reduce the number of duplicate bills that had to be made out each month from approximately 500 to an insignificant number.

GOVERNMENT BECOMES WHOLESALE PURCHASER OF CURRENT.

Instead of billing, as formerly, some 200 separate accounts for electric current used on that many meters in the limits of Fort McPherson, under the arrangement agreed upon recently between the Georgia Railway & Light Co. and the War Department, the power company now renders one bill to the government authorities at the fort for all the current consumed both at Fort McPherson and Camp Jesup. This current is read from the Camp Jesup meter.

Under this new arrangement the Government has bought all lines erected by the power company on the reservation and the company no longer does any retail business there. The Government authorities handle the whole retail situation, buying the current at wholesale.

WASHINGTON CITIES MAY EXTEND CAR LINES TO SUBURBS.

A statute, now in effect in the state of Washington, empowers cities owning street railways to extend their lines to any points as far as 8 miles outside their city limits. This enables Seattle, for instance, to so extend its car lines as to serve a number of small towns within such limits. It opens the way for the city to purchase and operate the Rainier Valley line which runs from the center of the city to Renton where there are several industrial plants, one of the largest of which is that of the Pacific Car & Foundry Co. The purchase of that line by the city eventually is a probability.

Operating Practice

Electric Furnace Load Reactor — Performance of Water-Backs for Stokers — Differential Relays — Ash Handling

SATURATED CORE REACTOR FOR ELECTRIC FURNACE LOADS.

Device Limits Current Rushes Without Lowering Power-Factor.

With some electric furnace loads the current and energy fluctuations oscillate between such wide limits as to cause disturbances to other loads in the system, particularly where the total capacity is relatively small, or when the furnace load constitutes a large proportion of the total load on a long feeder. In such instances a saturated core reactor, which is now in the process of development, is receiving attention as a solution to the problem, and allow the central station to take on this, otherwise desirable, load without disturbance to its lines.

This device consists of two similar transformers, per phase, one winding on one being connected in series with the similar winding on the other and with the load. The remaining windings, one on each transformer or reactor, are excited from a source of direct-current supply. Such a reactor offers a low reactance to alternating currents so long as the alternating in m.m.f. in the core is less then the direct-current m.m.f., but a high reactance to currents of a larger value, such that the alternating-current m.m.f. is greater than the direct-current m.m.f. That is, the maximum value of the alternating current can be limited to a relatively small percentage above normal, without having a large reactive drop at normal load. By adjusting the amount of direct-current excitation the maximum value of the alternating current can be varied.

The following test results indicate the way the reactor operates:

D. C. excitation in amperes.	A. C. line current in amperes.	Volts across reactor.
11.0	20	450
11.0	30	2,200
15.0	20	325
15.0	40	2,200

In considering the above results, assuming that the line voltage is 2200, and that normal line current is 20 amperes, we find that with 11.0 amperes d.c. excitation, at normal line current the reactance is equivalent to 20%, while at 150% current it is 66.6%. This means the current is limited to 150% normal. If the direct-current excitation is increased to 15.0 amperes, then at normal line current the reactance is 15%, and at 200% line current it is 50%. That is, the line current is absolutely limited to 200% or normal.

This reactor thus offers a means of limiting the maximum value of current surges without the disadvantage of a high reactance under normal conditions. The power losses in the reactor are exceedingly small, being only the I^2R loss in the two windings, and the core losses.

The above system of current limiting may be used in either single or polyphase circuits, two transformers being required per phase. Two transformers are necessary in order to eliminate the second harmonic voltages which are induced in the reactor windings. The first cost of an installation of this character is somewhat higher than the cost of ordinary reactance coils, but the advantages of the saturated reactor are so marked that first cost is soon forgotten in the better regulation, lower average power demand and higher power-factor.

OPERATING EXPERIENCES WITH WATER-BACKS FOR UNDERFEED STOKERS.

Operating Results Obtained by Philadelphia Electric Company.

If clinker grinders as used with the underfeed type of stoker are set quite deep below the fuel bed and the approach to the clinker grinders be sufficiently wide, trouble may be expected by the clinkers arching over at a deeper point in the pit unless proper provisions are made to prevent this occurrence. The Philadelphia Electric Co. has had considerable experience in the operation of these clinker grinders and have adapted water-backs as a means of preventing this trouble. If water-backs are properly designed, connected and operated, the troubles experienced by arching over the clinker grinders can be practically eliminated and the heat which is absorbed through the water-backs can be utilized without any loss.

At the recent N. E. L. A. convention John Dallas presented a brief summary of the experience of the Philadelphia Electric Co. with cast-iron water-backs installed in the bridge walls of 1500-hp. single-fired Stirling boilers.

Two boilers were installed in 1917 and have been in operation for a period of about a year and a half, during which time it has not been necessary to replace any of the water-backs. In this particular instance all of the boiler feed water for the two boilers was passed through the water-backs and into the open feed water heater, thus saving all of the heat absorbed through the water-backs.

The first water-backs as designed by the Philadelphia Electric Co. were of an oval section 6 by 12 in. outside and 4 ft. 6 in. long. On these particular water-backs there were from 2½ to 3 in. of the total length exposed to the direct heat in the furnace and the water passing through this type of water-backs absorbed 4½ to 5% of the total heat generated in the furnace. The design of these water-backs has since been changed by shortening them to 3 ft. in length. This has cut down the total heat absorbed through the water-backs to-from 1¾ to 2% maximum. While the length of the water-backs has been reduced by about 33%, the heat absorbed through the water-backs has been reduced by about 60%. This can be explained by the fact that in the long water-backs almost one-

half of the total length is exposed to the direct heat of the furnace, whereas in the short water-backs only about one-sixth of the length is exposed to this heat, the balance of the water-backs being below the top of the fuel bed where the heat would be considerably less than in the open furnace.

In the Chester Station, where there are eight single-fired Stirling boilers with Taylor stokers and clinker grinders, the water-backs are installed as follows: The water-backs are erected at the bottom of the bridge wall sloping inward at an angle of about 8° and are connected parallel to an inlet and a discharge header. These headers are placed at the back of the bridge wall and the pipes connecting the headers to the water-backs are provided with flanged unions so that any water-back section can be withdrawn without disturbing the bridge wall construction. The inlet header is at the bottom of the water-backs.

There are two main water supplies to the water-backs, one of which carries condensate water from the condensers, the other carrying raw water, which is for emergency use. The supply to each boiler is taken from either of these mains through a specially designed valve which ordinarily is set to allow condensate water to run through the water-backs and return through the same valve to the plant feed-water heater. By one operation of this valve, the condensate water is closed off and raw water is supplied to the water-backs and returned through the same valve to waste. In order to give protection against a failure of condensate water supply to these water-backs, there is a temperature alarm on each discharge header which is set at 160°F. so that if the water supply is too small, the temperature will rise and cause this alarm to ring, at which time the boiler engineer can throw over the supply from condensate to raw water. As an additional precaution against burning out these water-backs in case of a sudden shutting down of the turbines, there is a stand pipe with a regulating valve on the condensate main. This regulating valve is set at such a point that if the condensate water supply fails, raw water will be run in through the same main.

In this installation, all of the heat which is absorbed through the water-backs is saved and returned in the condensate water to the feed-water heater. By using only the condensate water from the condensers in all of the boilers operating under whatever load is being carried, the discharge temperature from the water-backs does not exceed 145° F. with 101° F. condensate water when carrying 28 in. of vacuum in the condenser. When carrying 29 in. of vacuum, the discharge temperature from the water-backs will not exceed 125° F.

The results obtained by this installation have been so satisfactory that the Philadelphia Electric Co. has no hesitancy in recommending this type of installation for all single-fired boiler settings where clinker grinders are used in connection with the stokers—in fact, it is believed that such an installation would be advantageous in any type of single-fired boiler setting with stokers.

DIFFERENTIAL RELAYS FOR GENERATOR CONTROL.

Selective Action for Internal But Not External Short Circuits Is Obtained.

While many companies, and the smaller ones especially, employ overload relays to protect their generators from severe overload, it has become more and more the practice to have the generators connected solidly through circuit-breakers so that the machines can be disconnected from the bus only by deliberate action on the part of the operator. This practice reduces the likelihood of service interruptions due to transient short-circuits and overloads.

On the other hand, the fact that a generator can be disconnected from the bus only after the attendant manipulates the circuit-breaker or its control circuit may result in more extensive damage being done a generator should it break down internally than would be the case if the circuit-breaker opened automatically on heavy current, because of the flow of current from the system into the defective generator.

By using a differential relay full protection of a generator against internal failures can be obtained, while the ordinary short-circuits on the line are ineffective in bringing the relay into operation. The differential relay functions only under unbalanced conditions or when a ground occurs in the generator. By using the differential relay a generator can be amply protected against internal trouble without tending to create the class of service interruptions that may so easily occur were the overload type of relay employed.

RELATIVE COSTS OF HANDLING ASHES MANUALLY AND MECHANICALLY.

Big Saving Accompanies Use of Steam Jet Ash Conveyor.

The accompanying comparative figures show the relative costs of handling ashes by ash wheelers and steam jet ash conveyor respectively. The boiler plant contains a battery of one 500 and five 150-hp. boilers operating continuously. An ash conveyor was installed replacing the use of men and horses. The ash-handling costs before and after the steam ash conveyor are as follows:

Cost of Ash Disposal Previous to Installation of American Steam Ash Conveyor per 24-Hour Day.

2 Ash wheelers	$5.44	$10.88	
1 Teamster	4.08	4.08	
1 Horse and feed	1.50	1.50	$16.46

Cost of Ash Disposal After Installation of Conveyor.

1 Laborer (9 hours)			4.08
Saving, 24 hour day			$12.38

(This laborer acts between fire cleanings as assistant fireman and boiler room helper.)

The ashes are left on the boiler room floor in front of the boiler until the cleaning is completed and are then put into the conveyor, which handles the complete cleaning in about 7 minutes. The boilers are cleaned every two hours.

It will be seen that the actual time the laborer spends at work handling ashes is relatively small. If the time spent on other work was charged against that operation the saving would be decidedly greater.

These figures bring home forcefully the economy that results from the installation of labor-saving equipment and emphasize the importance of carefully watching every item of boiler plant expense.

Corrosion of steel and rot of wood frequently occur at the junction where these materials are embedded in concrete. The reason is that moisture enters between the two substances. This can be prevented in a very simple manner, namely, by countersinking for a depth of one-half inch the cement around the steel or wood and filling this with hot tar or pitch.

Contracting-Construction

Chicago Code Changed—Service Switch Fuses—Program of New York Meeting—Urge Members to Attend Convention

PRINCIPAL CHANGES IN NEW CHICAGO ELECTRICAL CODE.

Enclosed Contacts and Safety Switches to Be Required in New Code.

The new Electrical Code of the City of Chicago which is being prepared under the supervision of Victor H. Tousley, chief electrical inspector, will contain many of the latest and most advanced ideas in electrical construction. This code has been recognized as one of the most complete and practical in use, especially for the larger cities, and although many of these new provisions are radical departures from the former codes, no opposition to them has as yet been encountered. They may therefore be taken as representing the consensus of opinion of the best code authorities and will undoubtedly be adopted in many other localities.

The most important changes from the former code are as follows:

All exposed live parts of apparatus must be guarded against accidental contact, either by the provision of suitable enclosures or by so locating the apparatus that only electricians duly qualified to handle it can come into contact with same.

All apparatus with exposed live contacts which in their ordinary operation produce arcs, must be provided with suitable enclosures or so located that nothing of a combustible nature will be in close proximity to same.

This rule shall not apply to trolley wires or other exposed live parts which from the nature of their use cannot be enclosed.

Note.—As the enforcement of this rule will require the enclosing of all exposed motor connections, motor-starting rheostats, automatic starting devices and similar apparatus, its enforcement will not go into effect until Jan. 1, 1920.

It can be seen that this rule is broad and far-reaching in effect and embodies a double provision. For example, to comply with the first paragraph, a motor commutator or automatic motor-starting device may be so located that the possibilities of accidental contact by unauthorized persons is eliminated or enclosed with a heavy screen, but if in its operation arcs are produced, unless it is free from the proximity of anything of a combustible nature, as required in the second paragraph, it would not be approved.

Another important change, requiring the installation of safety swicthes, has been made in Rule 24*b* which is to read as follows:

Knife switches, except on panelboards and switchboards, must be of the safety enclosed type.

Safety enclosed switches must be of an approved design and arranged to be operated from the outside of the enclosure. They shall be so marked as to indicate without opening the enclosure, whether the switch is in the "on" or "off" position. They shall be so constructed and installed that the fuses, if fuses are used, will be dead when the switch is in the open position, and except in the case of double-throw switches and alternating-current motor-starting switches designed for starting and running positions, must be so constructed and installed that the blades of the switch will be dead when the switch is in the open position.

If, in order to comply with the above, the incoming wires must be connected to certain terminals, such terminals must be marked "line."

The following changes have also been made in Rule 24, clearly defining the size of knife switches which it is permissible to use and the conditions under which circuit-breakers may be installed. It is the intention of this change to limit the size of knife switches to those that may be readily operated by hand. Although this feature has long been considered desirable, this is perhaps the first time that a definite rule of this kind has been made. These changes are as follows:

Rule 24*a*, 1st paragraph. Note.—A circuit-breaker may be used as a service cutout and switch where under competent supervision at all times (competent supervision to be determined by the department) if provided with means of ready manual operation. The circuit-breaker must be equipped with a trip coil connected into each wire of the circuit except a neutral wire grounded in accordance with Rule 15.

Cabinets containing service switch must not be locked or sealed unless switch can be operated from the outside of the cabinet.

Rule 24, *b*. Add new second paragraph: With three-wire direct-current or single-phase systems with grounded neutral, switches may be designed as to permit either outside wire to be opened independently of the others, but the design must be such that the neutral cannot be opened without opening both outside wires.

Knife switches used to break currents must be limited to the following capacities: three-pole switch, 1000 amperes; two-pole switch, 1500 amperes; single-pole switch, 3000 amperes. For capacities greater than that for which knife switches are approved, circuit-breakers or oil switches must be used. Where circuit-breakers or oil switches are used fuses must also be provided unless under competent supervision at all times.

Deviation from this rule may be allowed by special permission in writing.

In addition to the above, several other minor changes have been made, the principal ones being:

Rule 8, *c*, first paragraph. Change 13th line as follows: The switch and starting device must be located within sight of the motor except where this is impractical, in which case the switch and starting box may be located out of sight of the motor provided a switch disconnecting all the wires is placed at the motor and some means is provided to indicate to the operator when the motor starts.

Note.—The extra switch at the motor will not be required if the starting switch can be locked or otherwise made inoperative during the time of working on the motor.

Rule 12, *b*, second paragraph. Note.—This rule does not require lead covered wire for the underground service wires running between a house or other building and a private garage, provided these wires are protected by proper fuses.

Rule 12, *f*, fourth paragraph. Note.—Where a service outlet is terminated on a post supporting a porch, steel straps or braces must be fastened in such a manner that the post will be held firmly to the joist. Each strap must be at least 1 by 12 in. and ⅜ in. in thickness and fastened to the post and joist by lag screws, two in the post and two in the joist, such lag screws to be ¼ by 2½ in. Two straps must be used, one on each side of the post. Both straps and bolts must be galvanized.

Rule 12, *i*. Replace present note with following: Note.—Where the service supplies not more than one set of building mains the public service company must extend its service conductors to a point not more than 3 ft. inside the building to reach the service switch installed by the contractor; provided that in case it is not practical to locate the service switch within 3 ft. of the service entrance, the contractor must arrange with the public service company to extend the service conductors to the service switch. The contractor will install the service switch cabinet directly over the service

stub or, if this is impractical, will install a junction box over the service stub and extend the service wires in conduit to the service switch cabinet. In either case the public service companies' wires must be connected directly to the service switch terminals and there must be no joints or splices in the service companies' wires.

Where the service is likely to be used as a supply for more than one set of building mains, as in the case of sub-sidewalk services supplying small installations, the junction box over the service cables must be instaled by the public service company.

The final connection to the public service companies' mains must be made by the public service company.

In large installations where the service companies' cables are extended directly to a switchboard the service junction box may be omitted if the cables are extended in fireproof conduit under the floor or imbedded in at least 3 in. of concrete from the point where they enter the building to the service switch.

SERVICE CUTOUTS MUST PROTECT SERVICE SWITCHES.

Old Rule on This Subject Inadvertently Omitted from 1918 Code, But Still in Force.

In the 1915 edition of the National Electrical Code, the second paragraph of Rule 23, section *a*, read as follows:

"Where the switch required by No. 24*a* is inside the building, the cutout required by this section must be placed so as to protect it, unless the switch is of the knife-blade type and is inclosed in an *approved* box or cabinet, under which conditions the switch may be placed between the source of the supply and the cutout."

Through an error this section was omitted when the latest (1918) edition was printed.

The Electrical Committee of the National Fire Protection Association, which has charge of revision of the Code, has voted that this matter be given the widest publicity, that all interested parties may be advised that this section was inadvertently omitted. The Electrical Committee would recommend that inspection departments approve an installation in accordance with this paragraph.

INTERESTING PROGRAM ARRANGED FOR NEW YORK STATE MEETING.

Annual Convention at Saratoga Springs Promises to Be Most Successful Ever Held.

A very comprehensive program, dealing with all phases of the electrical contractor-dealer's business has been arranged for the annual convention of the New York State Association of Electrical Contractors and Dealers to be held June 23, 24 and 25, at the Grand Union hotel, Saratoga Springs, N. Y. The convention this year promises to be the most successful ever held by the association and an unusually large attendance is anticipated.

The convention will be opened at 2 p. m. on Monday, June 23, with an address of welcome to be delivered by Senator Edgar T. Brackett, of Saratoga Springs, to which W. C. Peet, of New York City, chairman of the National Association of Electrical Contractors and Dealers, will respond. W. H. Morton, general manager of the National Association, will then explain the advantages to the contractor of the data and sales book and a discussion of overhead costs and their application in estimating will be led by C. C. Dailey of Rochester, N. Y. Lynton T. Block, of the Utilities Indemnity & Fire Exchanges, St. Louis, Mo., will deliver an address on "Workmen's Compensation and Public Liability Insurance."

On Tuesday morning the meeting will be opened with an address on "Better Merchandising," by T. J. Casey, vice-president of the Hurley Machine Co., Chicago, Ill. Following this, Samuel A. Chase, of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will speak on the "Channels of Distribution Between Manufacturer and Consumer," and W. A. Kennedy, of New York City, on "Wholesale Only and Its Co-operative Benefits." In the afternoon, the members will be addressed by J. T. Hutchings, president of the Rochester Railway & Light Co., Rochester, N. Y., on "The Effect of Lighting Companies' Rates for Current on the Contractors' Business," and "The Menace of State Socialism in America," by F. G. R. Gordon, Haverhill, Mass. In the evening a reception and dance will be held for the members, guests and ladies.

On Wednesday the "Relations Between Jobbers and Contractor-Dealers" will be explained by J. J. Raftery, of New York City, and Louis Kalischer, of Brooklyn, N. Y., will describe the "Advantages of Co-operative Selling Campaigns." W. L. Goodwin, of the General Electric Co., Schenectady, N. Y., author of the "Goodwin" plan for electrical contractors and dealers, will then address those present. After Mr. Goodwin's address any questions deposited in the Question Box will be answered by him.

CONTRACTORS URGED TO ATTEND NATIONAL CONVENTION.

Novel Card Attached to Announcements of Final Meeting of Boston District.

The last meeting of this season of the Boston district of the Massachusetts State Association of Electrical Contractors and Dealers was held on June 19, at the Boston City Club. The topic of discussion on this occasion was the advantages to be derived from closer relationship between the engineer and electrical contractor. One of the principal speakers at this meeting was Fred W. Lord of the Lord Electric Co. of New York City.

Attached to the announcements of this meeting was a small card which is reproduced herewith. This

MAGNETIC—MILWAUKEE—DYNAMIC
Feel a charm *Magnet* attracting you?
Is a mysterious *Self-Starter* impelling you?
Is some secret *Transformer* inspiring you?
Is a positive *Current* carrying you?
Then *Live-Wire Milwaukee* is drawing you.
BE IN THE BIG *CIRCUIT*
YOU ELECTRICAL CONTRACTORS AND DEALERS
CONNECT WITH THE BIG *DYNAMO*
THE ANNUAL CONVENTION OF
The National Association of Electrical Contractors and Dealers, at
MILWAUKEE
JULY 14-19, 1919
This will be a more important meeting than any the National Association has ever held. It will be the first in the great readjustment period following the world war. Take your wife. Let her share in your business and pleasure.
WE'LL MEET YOU THERE!

Card Sent to Contractors Urging Attendance at National Convention in Milwaukee.

card in purely electrical terms urges all members to be present at the coming annual convention of the National Association of Electrical Contractors and Dealers to be held in Milwaukee July 14-19. This meeting promises to be the biggest and most important ever held by the association and every member should make an earnest effort to be present and take an active part in the proceedings.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 464.—TRANSFORMER DESIGN.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

No. 465.—UNDERGROUND CONDUIT.—The writer is about to install 4000 ft. of 1½-in. conduit underground to carry a No. 6 lead-covered single-conductor cable supplying a potential of about 1100 volts on a series "White Way" lighting system. As this conduit will only be about 8 to 12 in. under the sidewalk, I have been advised by an engineer of authority on metallurgy that a black iron pipe would last as long on this installation as galvanized conduit and he suggests that I use plain iron pipe and give it a good coating of asphaltum. The suggestion appeals to me from the standpoint of cost, which would only be about half as much as galvanized conduit and the material could be handled in 20-ft. lengths. I would like to take advantage of this suggestion, if practical, but don't want the cost to mislead me on a good job. I would like to hear from some of the readers experienced in this subject before going ahead with this installation.—W. W., Ludlow, Ky.

No. 466.—GROUNDING TRANSFORMERS AND SECONDARIES.—Up to the present time the undersigned has always grounded the neutral of secondaries on transformer poles, together with grounding the transformer cases at this point and installing the lightning arresters on the next pole away from the transformers. It is now strongly recommended by leading engineers that the lightning arresters be installed as near as possible to the transformers, which doubtless means on the same pole, and the neutral grounds will now have to be made at another point. I am in favor of this change and appreciate its protective advantages, but would like to hear from readers as to best location for the neutral grounds and their ideas on grounding the transformer cases.—H. M., Cincinnati, Ohio.

No. 467.—OPERATING COST OF ELECTRIC HOUSEHOLD REFRIGERATORS.—I woud like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

Answers.

No. 462.—ELECTRIC WELDING OF RAILS.—Is there a definite dividing line between spot and arc welding as to where one would be used and not the other, or does their utility overlap to a certain extent? I refer especially to the welding of street-car rails, for which both methods seem to have been used. Which method is preferred for this work?—T. N., Toledo, Ohio.

In the case in question, the inquirer probably means resistance welding instead of spot welding. There is no very sharp dividing line between these two classes of electric welding, that is, arc and resistance welding. Both may be used under proper conditions. As a general rule, arc welding is employed where the pieces to be joined are quite large and the surfaces must first be built up by fusing some extra metal into the joint through use of a metal electrode; it is also used where miscellaneous or mixed work is to be done, that is, where there is no repetition of the same work in a large number of cases that would be greatly facilitated by use of a special welding machine operating on the resistance principle.

For rail welding, assuming work for a considerable stretch of track, it is now quite common to employ a welding machine specially designed for the purpose. It makes a quicker and more reliable weld because it does not take so much skill to operate as the arc-welding process.—B. S. A., Chicago, Ill.

No. 463.—SERIES LIGHTING AND HOUSE SERVICE WIRES ON SAME INSULATORS.—A certain lighting company is using rubber-covered duplex wire to run down on poles to feed its street series lamps. It also runs down with rubber-covered duplex wire for 110-volt house service conections. The point in question is, does the tying of both these duplex wires in the *same insulator grooves* where the wires travel down the side of the pole not constitute both a fire and life hazard? My contention is that this is very apt to conduct the high voltage of the street series circuit into the house circuit. I would like to get some opinions on this.—W. M. G., White Plains, N. Y.

Answer A.—It is decidedly a dangerous practice to install street-lighting wires and service wires on the same insulators. Good practice dictates that primary wires and street-lighting wires be carried on an arm above the secondary arm, spaced at 2-ft. centers. Service drops should be run with weatherproof single-conductor wire, using liberal spacing. The service drops should drop directly from the line arm or from a buck arm, depending on the location of the house served.

Rubber-covered duplex wire used for street lights may be run down the pole on insulators with safety. The justification of this construction lies in the fact that, though the circuit voltage is high, the voltage between the two duplex conductors is low.—W. H. K., Evanston, Ill.

Answer B.—The inquirer's contention is borne out by the opinion of the best known authorities on electrical distribution. Series street-lighting circuits when alive carry a much higher voltage than secondary service circuits, consequently they must be not only distinct and separate, but separated by a distance depending on the difference in potential between the circuits. Running down the pole on the same insulators is therefore a very hazardous practice both from the standpoint of life and fire hazards. Breakdown of insulation on the wires is very likely to introduce a dangerously high voltage into the house with this construction. If the service drop cannot be carried directly from the cross-arm to the service-entrance fitting and must be run down along the pole, it should in the case in question be run down in iron conduit which is grounded, or the loop to the street lamp should be run in iron conduit properly grounded.—T. D. W., Indianapolis, Ind.

Answer C.—I should regard this as a very dangerous construction and would unhesitatingly condemn it. There is no specific provision covering just this point in either the National Electrical Code or the Safety Code to my knowledge, and I have searched both carefully. Yet it would constitute a serious fire and life hazard.—M. J. R., Troy, N. Y.

CORRECTION.

In Answer *E* to Question No. 460 on rails instead of trolley wires for traveling cranes, published in the issue of May 31, 1919, a typographical error was overlooked. It was stated that "extended aluminum shapes are used with alternating currents of large volume"; the word "extruded" should have appeared instead of extended. These shapes are made by drawing the metal through sharp dies instead of rolling as is customary, thus making these shapes closer to gauge and giving them sharper angles and fillets.

New Appliances

Attractive New Electric Washer—Centrifugal Apparatus for Treating Oils—Development of Safety Switch Features

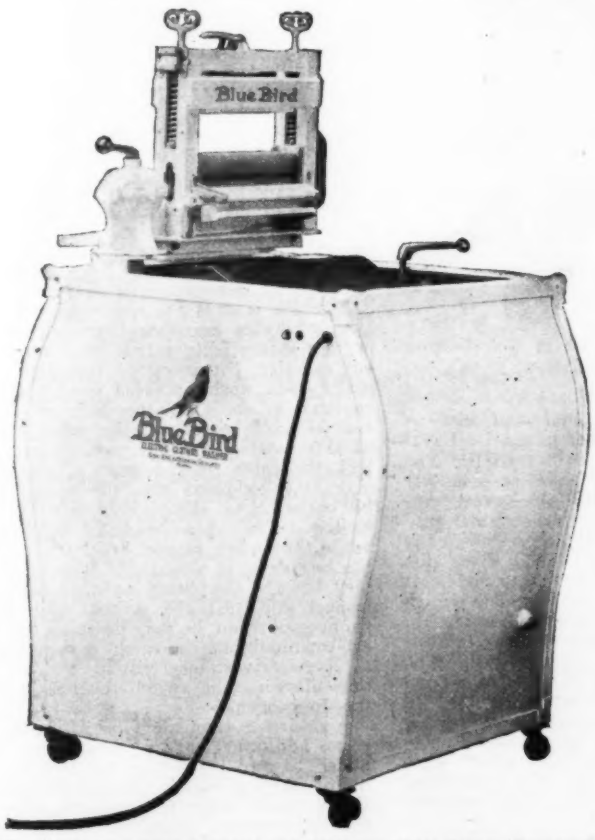
The Blue Bird Electric Washing Machine.

Great development has taken place in the last few years in the production of electric washing and wringing machines. This has been stimulated by the scarcity of domestic help and the high wages demanded by servants and visiting laundresses. The immediate result of this was a very heavy demand for washing machines, which in turn caused manufacturers to increase their production and also develop new types. Other manufacturing companies have also entered this business with new types, among these being the Blue Bird Manufacturing Co., St. Louis, Mo., whose product has a number of unique features.

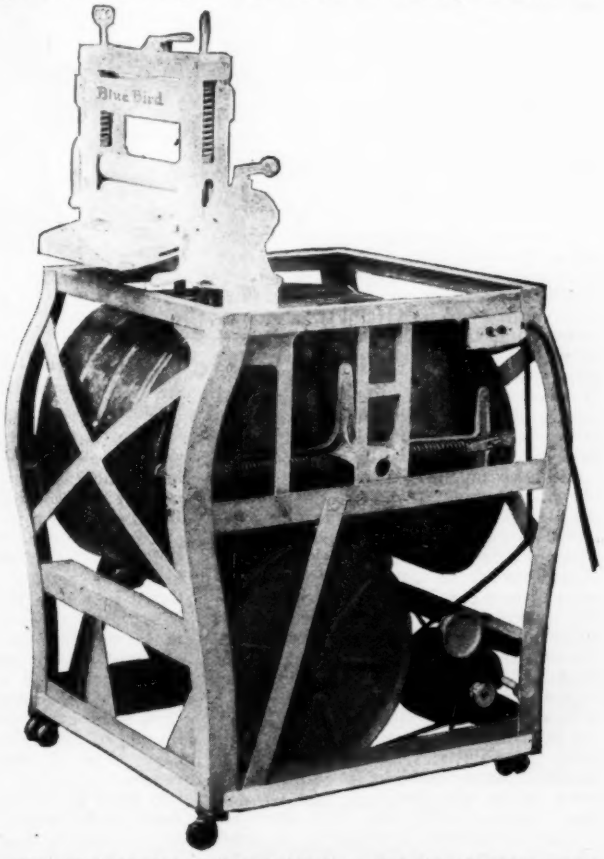
Organized as the National Tool & Manufacturing Co., this corporation made an enviable record in turning out several million dollars' worth of very exacting and precise war work in the last two years. Prompt deliveries secured for it much special emergency work for the Government. Its large manufacturing facilities in St. Louis have recently been adapted for the production of electrical appliances and the Blue Bird washer is the first of these to be perfected and marketed.

This new washer impresses one at first glance as being unique. This is because of the very attractive white cabinet in which it is encased. Like all the rest of the machine, except the wringer frame, this is of metal shaped in graceful lines and handsomely finished with a very durable white enamel, baked on. It is furnished with a white enameled sheet-metal top, which can be put on after the wringer is removed; the latter is easily done, so that with the top in place the cabinet can be used as a table. The first of the accompanying views gives some idea of the attractiveness of the design; the second illustration shows the machine before the cabinet walls are attached and gives a good idea of the strong angle-iron frame and arrangement of the tub, motor and drive within it. The main members of the frame consist of 2 in. by 2 in. by ⅛ in. angle irons, securely riveted and solidly braced to give rigidity and absence of vibration. All corners are reinforced and the entire frame is covered by a coat of rust-proof paint. The frame and cabinet serve not only to support the machine parts and hide them from view, but also to protect the user from any possible danger of having her dress caught in belts, pulleys or gears. Besides this safety feature, the motor is protected from splashing water.

For operating principle this machine uses an oscillating metal tub which swings through a large angle so that its ends are tilted up considerably, giving the clothes a 3-ft. fall into the soapy water at each reversal of the swing. This provides a very thorough agitation of the clothes and suds, which means effective and rapid cleansing action without damage to the clothes. It is said that a batch of clothes can be completely washed in 10 to 15 minutes, depending on how soiled they were. The tub has a capacity of 8 sheets and is made of heavy sheet copper with lap joints. The inside is entirely smooth and



The New Blue Bird Washer and Wringer With Cover Removed Ready for Use.



Blue Bird Washer Before Cabinet Is Put On, Showing Frame and Arrangement of Parts.

heavily tinned. A wide opening with heavy sheet copper cover tightly fitting over it is provided at the top. A double drain leads to an outlet to permit quick emptying of the tub, which is easily kept clean.

A special Westinghouse motor for washing-machine use is supplied. Its pulley drives through an endless belt kept tight by passing over an idler pulley; the driven pulley is connected to the gears so as to give a simple and direct drive that is positively alined. The motor is controlled by a simple switch; its operation of the tub through a clutch is controlled by a lever just above the top of the cabinet. There is only one other lever; it controls the wringer for starting, stopping and reversing. The wringer has an automatic safety release and can be swung to operate in three positions. It has 12-in. rolls and all its gears are inclosed.

The machine is mounted on large double-wheel, roller-bearing casters, making it easy to move about without scratching floors. A 10-ft. heavily insulated connecting cord is furnished. The cabinet dimensions are 26 by 31 in. by 34½ in. high; the height over the top of the wringer is 52 in.

Every effort has been made in the design of the machine and in its construction in a thoroughly modern plant to provide a durable and efficient as well as dependable and attractive washing outfit at a relatively moderate price. The facilities of the company, both manufacturing and financial are such as to permit production on a large scale while also carrying the accounts of dealers so they may sell the machines on installment payments.

These washing machines are being marketed through jobbers and local dealers by the Blue Bird Appliance Co., 22nd and Washington streets, St. Louis, Mo.

Centrifugal Apparatus for Reclaiming and Purifying Oils.

Modern practice tends to more generous use of oil in the lubrication of steam engines, internal-combustion engines, pumps, compressors, generators and motors—in fact, all kinds of machinery using oil for lubricating purposes. This floating of bearings and other parts of machinery exposed to friction in a bath of oil insures an ample supply at all times, reducing to a minimum the wear and danger due to insufficient lubrication.

Modern machine-shop practice also shows a tendency toward a more liberal use of oil for cutting and heat-treating purposes. The increased use of automatic machinery and the necessity for turning out more work of a better quality has resulted in larger oil consumption in every factory. Oil used for all these and similar purposes shortly becomes foul. It is bound to pick up all kinds of impurities during its passage to and through the various places where it is used. The continued use of such oil is, of course, very detrimental; the dust, grit, particles of metal and other foreign matter which it collects will raise havoc with bearings, pistons, cutting edges of tools, etc.

Another source of trouble is the presence of water in the oil. Water in the bearings, crank cases, etc., causes excessive and uneven wear, loss of power due to increased friction, which friction generates heat, causing premature destruction of the wearing surfaces. The presence of even a slight amount of water in cutting oils causes smoking as it passes over the work, which is a source of annoyance to the operators.

In an effort to minimize the detrimental effects of these impurities it has, in the past, been the practice in many places to allow the impurities to settle out by gravity in tanks. The oil in which the settlings were present was thrown away, causing a heavy loss.

A realization of the tremendous waste and other drawbacks of this practice brought upon the market several filtering devices which, however, are slow, wasteful, cumbersome and inefficient, as well as limited in their scope, as compared with the modern method developed by the De Laval Separator Co., 165 Broadway, New York. For that reason many of the largest manufacturing plants throughout the country have adopted the De Laval method.

Turbine-Driven De Laval Oil Purifier with Capacity of 350 G. P. M.

Even before the sharp advance in price of oils, it did not take a De Laval installation long to pay for itself. The present high prices have considerably shortened this time and also greatly emphasized the necessity for reclamation.

The De Laval multiple oil clarifier is used for separating solids from the liquid in which they are suspended. It has only one djscharge through which the liquid escapes, while the solids are retained in the sediment pockets provided inside the revolving bowl. The De Laval oil purifier consists of a bowl with two outlets through which the two liquids of different specific gravities escape. The oil filter of the same make removes the last particles which were too light or so minute that centrifugal force alone would not readily separate them from the liquid.

The De Laval oil refining and reclaiming apparatus can be used, of course, for treating lubricating and fuel oils, and oil that has been used for automobile engine crank cases, axles, and for cutting purposes with all forms of machine tools, by which 20 to 55% saving accrues, better work and finish is accomplished, and the possibility of septic poisoning is almost eliminated.

Development of Safety Features in Trumbull Enclosed Switches.

The "Safety First" movement has been making steady headway for many years, although during the war the rush for production necessarily caused it to be less prominent in the attention demanded of the public. Nevertheless, further headway has been achieved and especially in the electrical line where the movement for requiring safety enclosed switches in place of the old knife switch with exposed blades and terminals has made much progress. Not only are safety switches now required in many cities and states, but more definite safety features are required in their construction, so that a review of the development of these safety features in a typical line of approved switches is worthy of attention.

We have selected the safety switches made by the Trumbull Electric Manufacturing Co., Plainvile, Con., as typical of the most approved practice in safety switch construction. In their design the effort was made to incorporate all essential features to make these switches as safe and foolproof as possible. The first thing settled was to provide a metal enclosure which would positively prevent a workman or other person from coming in contact with the switch blades as long as the switch was closed or "live." This meant a substantially built box that positively could not be opened until the switch was thrown to "off" position. A steel box of ample strength was readily provided, the cover or door of which was arranged with a deep flange to make it rigid and fit well around the body of the box. Substantial hinges and a catch were provided.

The latter insures that the box remains locked until the switch is opened by means of the operating lever projecting from the side. At the same time this catch serves to prevent closing the switch after the box has been opened until the door or cover is first closed. This catch is thus practically an interlocking device incorporating two important safety features. It is of simple but positive construction, including a gravity and spring-pressed pawl which engages a notch in the hub of the switch-handle pivot; in the other end of this pawl is a finger that serves to lock the catch on the door. This insures the condition that the door can be opened and closed only when the switch is in open or "off" position, while the switch cannot be closed until the box door is closed. If it is necessary for the electrician or inspector to inspect and test the switch while in running position, he may do so by properly manipulating the catch by means of a screw-driver inserted in the slot, thus allowing the switch to close with the door open.

A desirable refinement, which is really an additional safety feature, can be added to any fusible service switch or motor-starting switch. It consists of a shield placed over the contacts where the line enters. Since the blades and fuses are always dead when the box is open, this protects anyone from contact with the remaining live contacts.

Lately Approved Appliances

Underwriters' Laboratories, established and maintained by the National Board of Fire Underwriters (for service—not profit), have examined, tested and listed these electrical appliances in accordance with the Laboratories' Code for Construction and Test of Electrical Appliances. Copies of complete lists of standard appliances may be obtained from local inspection departments or from offices of the Laboratories in the principal cities.

Autostarter—Industrial Controller Co., Milwaukee, Wis.

Oil-immersed switch and air-cooled transformer mounted as unit in metal case, with no-voltage release coil and with overload protection in form of two relays also contained in the autostarter case.

In "off" position windings and motor are completely disconnected from line. Overload release is inoperative during process of starting motor, and other circuit-breakers or fuses are necessary in motor circuit.

"I-C." Capacities 50 hp. and less, 600 volts or less. Class Nos. 2205, 2206, 2210, 2211.

Listed Jan. 25, 1919.

Autostarters. — Western Electric Co., 463 West street, New York.

Automatically controlled contactors and air-cooled compensators mounted as unit on plate panel; separate switches are required to disconnect line wires. Used as means whereby potential impressed on alternating-current motor terminals may be made less than full line voltage during starting process.

Capacity 200 hp. or less, 600 volts or less. Type CR=2363.

This manufacturer also furnishes autostarters for circuits of voltages higher than 600. These will be generally acceptable for use when installed in accordance with requirements of inspection departments having jurisdiction.

Listed Feb. 17, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—The Electrical Manufacturing Co., 112 Hamilton avenue, N. E., Cleveland, Ohio.

Listed Feb. 24, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—Robertson Electric Construction Co., Mohawk and Niagara streets, Buffalo, N. Y.

Listed March 31, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—Star Metal Box Co., 507 West 19th street, New York, N. Y.

Listed March 5, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—Thomas & Betts Co., 63 Vesey street, New York, N. Y.

Listed Feb. 17, 1919.

Conduit, Rigid Steel.—National Enameling & Manufacturing Co., Renshaw Building, Pittsburgh, Pa.

Enameled, electrogalvanized and hot-galvanized conduit.

Listed April 4, 1919.

Conduit Boxes.—F. H. Ward, 72 Carlton avenue, Brooklyn, N. Y.

Cast-iron conduit boxes, for use with flexible steel conduit or armored cable. Types A, C, E, J, S.

Listed Feb. 27, 1919.

Conduit Boxes.—Appleton Electric Co., 212-14 North Jefferson street, Chicago.

"Unilets," pressed steel. Series FSR, GE, GG.

Listed May 20, 1919.

Conduit Boxes, Fittings for—Covers.—Pass & Seymour, Inc., Solvay, N. Y.

Porcelain covers for conduit boxes for use as rosettes. Catalog Nos. 1167-68.

Listed Feb. 13, 1919.

Current Taps.—The Arrow Electric Co., Hartford, Conn.

"Arrow E." Adapter caps, Catalog No. RJ.

Listed March 12, 1919.

Current Taps.—The Bryant Electric Co., Bridgeport, Conn.

"Bryant" or "Perkins," multiple type.

Keyless, 660 watts, 250 volts. Catalog No. 101.

Listed Feb. 4, 1919.

Cutout Bases, Plug-Fuse.—The Chelten Electric Co., 4859-65 Stenton avenue, Philadelphia, Pa.

"Chelten," O-30 amperes, 125 volts. Catalog Nos. 1935, 2199, 2587, 2965.

Listed Feb. 18, 1919.

Fixtures.—H. E. Bullington, 212 North Adams street, Richmond, Va.

Listed April 10, 1919.

Fixtures. — Ben Engelberg, 116 North Eighth street, Richmond, Va.

Listed May 1, 1919.

Fixtures — Lightolier Co., 571 Broadway, New York, N. Y.

Listed March 13, 1919.

Flexible-Tubing Fasteners. — National Metal Molding Co., Pittsburgh, Pa.

"Nat. No. 2230," for securing flexible tubing in outlets. Catalog No. 2230.

Listed April 22, 1919.

Fuses, Cartridge.—Commercial Enclosed Fuse Co., 1317 Willow avenue, Hoboken, N. J.

"Commercial" cartridge enclosed fuses.

0-600 amperes, 250 volts.

Listed Feb. 5, 1919.

Fuses, Cartridge.—Killark Electric Manufacturing Co., 3940 Easton avenue, St. Louis, Mo.

"Killark" cartridge enclosed fuses. 0-200 amperes, 600 volts.

Listed Feb. 10, 1919.

Heaters, Air.—American Electrical Heater Co., Woodward, Burroughs and Cass avenues, Detroit, Mich.

"American Beauty Twin Radiant," 660 watts, 250 volts or less. Catalog No. 6215.

Listed April 1, 1919.

Heaters, Air.—Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

"Westinghouse," "Square" type.

Type D, non-luminous, 1000-3000 watts, 100-250 volts, styles 229942-49 inclusive, 229998-230001 inclusive, 280,-532-38 inclusive.

Listed March 17, 1919.

Heating Appliances, Cooking and Liquid.—Westinghouse Electric & Manufacturing Co., East Pittsburgh.

"Westinghouse." Disk stoves, 600 watts, styles 270701-02.

Ranges 14 kw. or less, 110-220 volts. Styles 266931-33-35, etc., to 61 inclusive, 278604-11 inclusive, 278881-932 inclusive.

Hot plates, 660-2000 watts, 100-250 volts. Styles 231562, 231564, 231566-69 inclusive, 266968-70-72-74.

Listed March 17, 1919.

Heating Appliances, Cooking and Liquid.—Westinghouse Electric & Manufacturing Co., East Pittsburgh.

"Westinghouse" electrically heated cooking appliances having heaters removable from stands or vessels with which they are intended to be used.

Water heaters, 500-1100 watts, 100-250 volts, Styles 151105-06, 170996.

In these devices no adequate means have been provided for eliminating hazard (similar to that of electric pressing irons) resulting from possibility that heating elements with current "on" may be left on combustible material, such as tables or cloths, and thereby cause fires. In this respect such heating devices are judged from point of view of fire hazard to be inferior to similar appliances equipped with stands or feet which insure permanent separation from surfaces on which they rest. In other electric and mechanical details these heaters are judged to be suitably constructed.

Listed March 19, 1919.

Heating Appliances, Industrial and Laboratory. — American Electrical Heater Co., Woodward, Burroughs and Cass avenues, Detroit, Mich.

"American Beauty." Soldering iron, 100 watts, 250 volts or less, Catalog No. 3138.

Listed April 1, 1919.

Lightning Rods.—The George E. Thompson Lightning Rod Co., Owatonna, Minn.

Listed May 16, 1919.

Miniature Motion-Picture Machine.—The Victor Animatograph Co., Davenport, Iowa.

Portable motor-operated motion-picture machine of miniature type.

"Victor Safety Cinema." Electrical parts of device comprise a 72-watt, 12-volt, gas-filled lamp with regulating rheostat; variable-speed driving motor; portable cord and attachment plug, 660 watts, 110 volts.

For use with slow-burning film only.

Listed Feb. 7, 1919.

Outlet Bushings.—Cameron Overbagh, Chicago, Ill.

Connector bushings of malleable iron with lock nut and bushing for use with armored cabled or flexible steel conduits.

"Two in One." For ½ in. knockouts.

Listed March 26, 1919.

Panelboards. — Sprague Electric Works of General Electric Co., 527 West 34th street, New York, N. Y.

Consisting of assembly of busbars with or without standard cutout parts, or with or without standard switches mounted on insulating bases. Designed for use on low-potential circuits.

Panelboards with brush-type mainline and tumbler-type branch-circuit switches, with or without plug or cartridge enclosed fuse cutouts. Types TPS, TES.

Listed Jan. 28, 1919.

Panelboards — Trumbull Electric Manufacturing Co., Plainville, Conn.

Consists of assembly of busbars, with or without standard cutout parts, or with or without standard switches mounted on insulating bases. Designed for use on low-potential circuits.

Listed April 23, 1919.

Portable, Flexible Cord for Electric Heaters.—Eugene F. Phillips Electrical Works, Ltd., De Gaspe and Marmier streets, Montreal, Can.

Marking: Two cotton threads cabled with copper strands.

Tag on coil to read "Nat'l Elec. Code Standard."

Listed Jan. 10, 1919.

Receptacles for Attachment Plugs, and Plugs—Benjamin Electric Manufacturing Co., 120-128 South Sangamon street, Chicago, Ill.

"Benjamin," 660 watts, 250 volts, Catalog No. 7641; with plugs 7624-25.

Listed Feb. 11, 1919.

Receptacles for Attachment Plugs, and Plugs.—The Bryant Electric Co., Bridgeport, Conn.

"Bryant" or "Perkins," 10 amperes, 250 volts. Spartan Catalog No. 127.

Listed March 3, 1919.

Receptacles, Medium-Base.—Pass & Seymour, Inc., Solvay, N. Y.

"P. & S." porcelain shell.

Keyless, Catalog No. 28795.

Pull, Catalog, No. 829.

Listed April 16, 1919.

Receptacles, Medium - Base. — Trenton Electric & Conduit Co., Trenton, N. J.

"T. E. & C. Co." Porcelain shell.

Keyless, Catalog No. 181.

Listed April 15, 1919.

Receptacles, Mogul-Base.—General Electric Co., Schenectady, N. Y.

Porcelain shell.

Keyless, Catalog No. GE1194.

Listed April 22, 1919.

Resistance Appliances. — National Electric Controller Co., 154 Whiting street, Chicago, Ill.

"National" speed regulators. 250 volts or less, Type R. Catalog Nos. 92-S to 111-S inclusive, 125-260 inclusive.

Listed May 16, 1919.

Resistance Appliances. — Ward Leonard Electric Co., Mount Vernon, N. Y.

Enameled resistance units when suitably mounted on bases of noncombustible material.

Listed Feb. 5, 1919.

Signal Appliances—Marine Bells and Buzzers and Horns.—Benjamin Electric Manufacturing Co., 120-128 South Sangamon street, Chicago, Ill.

"Benjamin" electromagnetic bells and buzzers, 125 volts or less, direct current or alternating current.

Water-tight bells, Catalog Nos. 8378-82 inclusive, 8384.

Water-tight buzzers, Catalog Nos. 8370, 8416, 8475-77 inclusive.

Water-tight horns, howler type. Catalog Nos. 8540-41 inclusive.

Non-water-tight bells. Catalog Nos. 8484-92 inclusive.

Non-water-tight buzzers, Catalog No. 9417.

Listed April 3, 1919.

Signal Appliances — Bells and Horns.—Schwarze Electric Co., Adrian, Mich.

"Schwarze" bells, 550 volts or less. Catalog Nos. 6B, 6C, 6E, 9A, 20, 21, 22A, 24, 30.

Horn, 50 volts or less, Catalog No. 3.

Listed March 14, 1919.

Soldering Flux.—The M. W. Dunton Co., 150 Niagara street, Providence, R. I.

"Nokorode." Soldering flux in form of paste, for use in soldering copper, brass, galvanized iron, tin plate, etc.

Not likely to cause corrosion of soldered parts. Forms secure mechanical and electrical bond between solder and metal to which it is applied.

Listed March 12, 1919.

Soldering Flux.—McGill Manufacturing Co., Valparaiso, Ind.

"Star" and "Crescent." Soldering fluxes in form of pastes and sticks for use in soldering copper, brass, galvanized iron, tin plate, etc.

Not likely to cause corrosion of soldered parts. Forms secure mechanical and electrical bond between solder and metal to which it is applied.

Listed March 14, 1919.

Switches, Automatic—Magnetically Operated Type.—The Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

Automatic switch consisting of contacts actuated by overload relay with adjustable load and time element.

0-100 amperes, 0-600 volts. "C-H" Bulletin 10175.

Listed Jan. 18, 1919.

Switches, Enclosed—The Trumbull Electric Manufacturing Co., Plainville, Conn.

"Circle T." Three and four-pole motor-starting knife switches with clips for standard cartridge enclosed fuses which are short-circuited when switch is in starting position. Enclosed in metal cases and designed for manual operation without opening cases. 30 and 60 amperes, 250 and 500 volts, alternating current. Catalog No. 13549.

Listed Feb. 7, 1919.

Switches, Knife—The Chelten Electric Co., 4859-65 Stenton avenue, Philadelphia, Pa.

"Chelten." 30 amperes, 125 volts. Catalog No. 901.

30 amperes, 250 volts, Catalog No. 903.

Listed Feb. 18, 1919.

Switches, Oil-Break.—General Electric Co., Schenectady, N. Y.

"G. E." Oil-immersed switches.

Spring finger type. 30 amperes, 600 volts, non-automatic Type FP-15.

Note: This company is also prepared to furnish for circuits of higher voltages oil switches and circuit-breakers which it guarantees to be suitable for use at assigned ratings of current and voltage. Inspection departments having jurisdiction should in all cases be consulted before such switches or breakers are installed.

Listed Jan. 27, 1919.

Switches, Push and Rotary Flush.—The Bryant Electric Co., Bridgeport, Conn.

Single-pole, Catalog Nos. 2707-08.

Three-way, Catalog No. 2903-M.

Listed May 7, 1919.

Switches, Push Flush.—Francis Keil & Son, 401-25 East 163rd street, New York, N. Y.

Single-pole, Catalog No. 32511.

Double-pole, Catalog No. 32512.

Three-way, Catalog No. 32513.

Listed March 27, 1919.

Transformers, Bell-Ringing.—Viking Electric Co., 150-52 Chambers street, New York, N. Y.

"Viking." Air-cooled transformers designed to supply current at following voltages. For use only in ringing bells or for similar signaling work, when primary wiring is installed in accordance with Class C rules, National Electrical Code.

60 cycles, primary 110 volts.

Secondary 8 volts, Type A.

Secondary 8-14-22 volts, Type B.

Listed March 12, 1919.

Transformers, Lighting.—Gardner Electric Manufacturing Co., 1368 Park avenue, Emeryville, Cal.

"Gardner." Air-cooled indoor transformers designed to supply current at following voltages to incandescent lamps for house lighting or electric signs. For use only when installed and wired in both primary and secondary circuits in accordance with Class C rules, National Electrical Code.

60 cycles, 500 volt-amperes. Primary 440, 220 volts; secondary 220, 110 and 6 volts.

Listed April 12, 1919.

Trade Activities

Maher Engineering Organized—Electric Storage Battery Entertained by Engineers—Valuable Literature Distributed

The Van Dorn Electric Tool Co., Cleveland, Ohio, has issued a leaflet on its portable electric drills. These are briefly described and numerous views are shown of their application for various purposes. The Van Dorn bench drilling stand is also shown and briefly described.

Chicago Mica Co., Valparaiso, Ind., manufacturer of mica, at the annual meeting held recently, elected the following officers: President, A. W. Pickford; vice-president, L. L. Fleig, and secretary-treasurer, John F. Griffin, all of whom have taken over a majority interest in the company. During the past few years the company's endeavor has been toward a high standard of Micabond insulation in quality, uniformity of product and service, and assures the trade of much greater efforts upon the part of the present owners to work toward their individual requirements.

The Automatic Electrical Devices Co., 120 Opera Place, Cincinnati, has prepared some very convenient cards showing standard charging rates for lead and Edison storage batteries. The lead batteries for which the rates are given are four types of Exide batteries, ranging in size from 7 to 35 plates per cell. The Edison batteries range in size from 2 to 18 plates. In each case the normal charging rate as well as the boosting rate is given. These tables have been prepared in connection with the company's line of storage battery charging equipment, which is especially suitable for industrial trucks and tractors using these types of batteries.

Crystal Washing Machine Co., Detroit, Mich., has prepared for the dealer an excellent merchandising plan book. The book is gotten up in a very attractive manner and outlines a sound sales plan, which if applied by the dealer is bound to result in increased sales of the Crystal washing machine. In order that dealers may cash in on the tremendous profit possibilities of this labor-saving device, the Crystal company offers without cost to the dealer a complete line of attractive window displays, newspaper advertisements, electrotypes of trademarks, washer and gold medal of award, demonstration books for salesmen, window cards, moving picture slides, sales letters and literature for distribution, and is an opportunity which the dealer cannot afford to pass by.

The Maher Engineering Co. has been organized with offices at 818-819 Michigan Boulevard building, 30 North Michigan boulevard, Chicago. This new concern will take over the mechanical equipment accounts formerly handled by the Adams & Maher Co., which becomes a construction company. The accounts handled by the new organization are Dayton-Dowd Co., centrifugal pumps; Erie Engine Works, steam engines; Wagener Steam Pump Co., direct-acting pumps; Sims Co., feed water heaters and hot water generators and Pratt Engine & Machine Co., fertilizer machinery and sulphuric acid plants.

The officers are E. E. Maher, president, long identified with the mechanical equipment business in the Middle West. Lieut. Lincoln E. Maher, treasurer, and C. B. Adams, secretary. Lieutenant Maher has just returned from France, having served 22 months with Company C, 132nd Infantry, 33rd Division. He was commanding officer of Company C during the severest fighting and served with distinction, winning great credit for his fearlessness and efficiency in action.

DeLaval Steam Turbine Co., Trenton, N. J., is distributing a very interesting publication devoted to geared marine steam turbines. In this bulletin are clearly pointed out the many advantages of the geared marine steam turbine over the reciprocating engine for ship propulsion, which have led to its adoption as the propelling unit for many ships. These may be summarized as follows: Greater speed from a given weight of power plant; greater steaming radius or greater speed from the same weight of fuel, or greater cargo carrying capacity with the same speed or steaming radius; also lessened expense for attendance and supplies, and increased reliability, as shown by less time lost in overhauling and repairs. A detailed description of this turbine is entered into and many illustrations of the engine included in the publication.

Morse Chain Co., with principal offices in Ithaca, N. Y., and branch offices in the principal cities of the United States, has issued a 12-page pamphlet treating with chain drives, and aims to present to textile engineers a short synopsis on the general subject of chain drives rather than to attempt to exploit any particular make or type of power chain. It is well illustrated and contains considerable engineering data conforming to the best practice at the present time and will prove very useful as a reference book to the engineer. In the pamphlet is reprinted an article by J. S. White, which appeared in the 1919 year book of the National Association of Cotton Manufacturers, setting forth the tremendous possibilities in the field of chain driving and the many advantages accruing from the use of chain drives in general power transmission work. The Morse Chain Co. is the sole manufacturer of the Morse rocker joint chain designed for power transmission purposes, and it is generally recognized as possessing great merit by engineers throughout the country. The rocker joint in these chains is free from prevailing lubrication difficulties, resulting in long life and high efficiency of the silent chain. In the United States there are now in daily service Morse chain drives transmitting an aggregate of approximately 3,000,000 hp.

Marble-Card Electric Co., Gladstone, Mich., has prepared Bulletin 100, which describes in detail its complete line of MC direct current motors and dynamos, ranging in sizes from ½ to 75 hp. The motors and generators described are the result of John F. Card's 26 years' experience in designing and manufacturing direct-current machinery for all classes of service, and there are now some 40,000 motors and generators after his design in successful operation throughout the United States and in many foreign countries. These machines have been built to meet the demand for a motor capable of withstanding continuous service at full load and with sufficient reserve capacity, both electrical and mechanical, to take heavy overloads without showing signs of distress. All standard machines are of the commutating pole type with ball bearings of liberal capacities to eliminate any strain that might be placed upon them through gear drive, which is usually considered the most severe.

The Electric Storage Battery Co., Chicago office, was the guest of a number of engineers and representatives of truck and tractor manufacturers on June 13. About fifty gathered together and after an inspection of one of the large stand-by Exide batteries in the Adams street station of the Commonwealth Edison Co., they partook of luncheon at the Chicago Yacht Club. During and after luncheon matters pertaining to batteries were discussed and many interesting personal experiences and creditable performances of electric trucks and tractors related. The battery at Adams street, originally 152 cells of 87 plates each, installed in 1898 and reconstructed in November, 1915, now consists of 150 cells of 91 plates each, a number of the original plates still being in service. The battery has a rating of 28,800 amp. for 20 minutes continuously at approximately 120 volts. This is one of 29 "Exide" central-station batteries installed for the Edison company and one of a total of more than 200 central station batteries installed throughout the country, the combined rating of which is more than 3,350,000 amp. at the 20-minute rate on the 120-volt bus. The meeting was in charge of G. H. Atkins, who acted as host.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Arrangements have been completed whereby the Rutland Railway, Light & Power Co. will supply the John Jones Slate Quarry with electric current to operate two 35-hp. motors for hoisting purposes, a 50-hp. motor for an air compressor, and a 10-hp. motor for a pump. The Jones company has arranged to advance the cost of the extension to the quarry, work upon which will be started in the near future. It is expected the slate company will be able to use the electric drive at the quarry in about two months.

Boston, Mass. — Boston Elevated Railway Co. is having plans prepared for the installation of two new multistage, turbine centrifugal pumping units, each of 3000 gal. per minute capacity in the power station at Lincoln street. It is understood that the Edison Electric Illuminating Co. is also arranging plans for the installation of similar units in its plant, with provisions for the installation of a third unit at an early date.

Jamesville, Mass.—Worcester Wire Co. is making rapid progress on the construction of its new local wiring manufacturing plant at Ludlow and Graham streets in the Jamesville section, and it is understood that operations will be inaugurated at an early date.

Leominster, Mass.—Viscoloid Co. has recently awarded a contract to the J. W. Bishop Co., Worcester, for the construction of a gravity section dam and pumping building at its plant, the dam to be about 200 ft. long, 24 ft. high, with a 60-foot rollway. The latter structure will be one-story, about 17x21 ft., of reinforced concrete.

Marlboro, Mass.—Marlboro Electric Co. has recently completed negotiations for the purchase of property on Garfield street, near Florence street, to be used for proposed expansion.

Webster, Mass.—Plans are under consideration by the city for the installation of a new electric street lighting system of the "white way" type commencing at Merino bridge to the Junction of Lake, South Main and Main streets; Harris street, and to the junction of North and East Main streets.

Worcester, Mass.—Plans are being arranged by the Committee on Street Lighting of the City Council for extensions in the electric street lighting systems on various streets.

Worcester, Mass.—James Smith & Sons, Hope avenue, have had plans prepared for the erection of a new manufacturing building and boiler plant addition at its works, two-story, about 100x220 ft., estimated to cost $20,000.

Waterbury, Conn.—American Bross Co. will erect a one-story power house, 35x50 ft., at an estimated cost of $50,000.

Providence, R. I.—The Atlantic mills will build a brick and steel power house, 46x98 ft. in dimensions.

Babylon, L. I., N. Y.—Babylon Railway Co. is understood to be considering plans for the installation of a new electric plant for the generation of electric energy for the operation of its traction system.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has recently been awarded a contract by the Endicott Johnson Corp. for the wiring and supplying of electric energy for 36 new houses to be erected by the corporation.

Brooklyn, N. Y.—Brooklyn Rapid Transit Co., Lindley M. Garrison, receiver, has been authorized by Judge Mayer, of the Federal District Court, to purchase for a consideration of about $225,000, the power plant and property at Kent and Division avenues, Williamsburg, now owned by the Brooklyn City Railroad Co.

Central Islip, N. Y.—Plans are being arranged by the Board of Managers of the Central Islip State Hospital for the construction of a new power plant at the institution, and the installation of considerable new equipment. It is proposed to install new boiler apparatus, coal and ash conveying and handling equipment, new piping, with auxiliary apparatus. E. S. Elwood is secretary of the State Hospital Commission; L. F. Pilcher, Capitol building, Albany, is State Architect.

Corning, N. Y.—Corning Glass Works has arranged plans for the construction of a large new boiler plant at its factory, for increased operations. The structure will be one-story, about 50x80 ft. Estimated cost $20,000. S. Firestone, Granite building, Rochester, is engineer for the company.

Hornell, N. Y.—Improved lighting is proposed. The Hornell Electric Co. is now preparing plans and estimates and within a short time it will be definitely known just what the expense of the undertaking will be. Address general manager.

Long Island City, N. Y.—Queens Electric Light & Power Co., 444 Jackson avenue, has completed the preparation of plans for alterations and improvements in its factory located at Bridge Plaza, between Radde and Academy streets. The proposed work is estimated to cost about $30,000. H. W. Knowles, 103 Bridge Plaza, is architect for the company.

New York, N. Y.—New York Edison Co., Irving Place and 15th street, is having plans prepared for the construction of a new three-story brick transformer station at 421-23 East Sixth street. The structure will be about 43x75 ft., and is estimated to cost $60,000. William Whitehill, 32 Union Square, is architect for the company.

New York, N. Y.—Considerable electrical equipment and machinery will be used in the proposed plant of the Newsprint Reclaiming Corp., 512 Fifth avenue. The company plans for the construction of a new reinforced-concrete mill in this section, with initial capacity of about 100 tons of reclaimed newsprint per day. At a later date it is also planned to construct larger mills at Chicago and Boston.

New York, N. Y.—American Gas & Electric Co. has recently voted for an increase in the common and preferred stock to $25,000,000, at a meeting of stockholders.

Niagara Falls, N. Y.—Niagara Falls Gas & Electric Light Co. has planned to erect a $200,000 plant at Buffalo avenue and 27th street.

Norwich, N. Y.—Norwich Wire Co., manufacturer of wire products, etc., has filed notice with the Secretary of State of an increase in its capitalization from $125,000 to $500,000, to provide for general business expansion.

Oswego, N. Y.—An engineer has been employed to prepare estimates for the construction in this city of a steam operated power plant to light the streets of the city and public buildings. Address Mayor Fitzgibbons.

Rochester, N. Y.—North East Electric Co. has completed plans for a six-story factory, 61x206 ft., to be erected on Whitney street. H. W. Fowler, 348 Whitney street, is superintendent of construction.

Bernardsville, N. J.—Plans are under consideration by the Township Council for the construction and development of a municipal water system, estimated to cost about $100,000. Considerable new electrical equipment and machinery will be required in connection with the proposed system.

Cape May, N. J.—The United States Government has recently completed arrangements for the erection of the proposed pump and gasoline building and equipment at the local Government site. The work is estimated to cost about $150,000.

Dover, N. J.—New Jersey Power & Light Co. has secured a contract from Roxbury Township, which comprises Succasunna, Kenvil, and Ledgewood, for 100 street lamps. These lamps are 6.6 amp., 32 cp. The revenue derived from this source will approximate $1800 per year. The Richards Co. has also contracted for current

to operate a 20 hp. motor for a refrigerating plant.

East Orange, N. J.—East Orange Starting & Lighting System Co. has filed notice of organization to operate at 391 Central avenue for the manufacture of electric starting and lighting systems, etc. Eugene Bogstahl, 644 Anderson avenue, Grantwood, heads the company.

East Orange, N. J.—Battery Service & Starter Co. has filed notice of organization to operate at 490 Main street for the production of storage batteries. Richard G. Pfeiffer, 10 University place, and Millard J. Weatherhead, 540 Main street, head the company.

Hoboken, N. J.—Cooper Hewitt Electric Co., Eighth and Grand streets, manufacturer of electric lamps, lighting systems, etc., has filed notice with the Secretary of State of an increase in its capitalization from $1,000,000 to $2,000,000, to provide for general expansion.

Jamesburg, N. J.—An appropriation of $25,000 has been arranged for the proposed installation of a new heating system in the New Jersey State Home for Boys, Jamesburg, plans for which are now being prepared. Dr. J. M. McCallie is in charge. Francis H. Bent, 142 West State street, Trenton, is state architect.

Newark, N. J.—American Art Lamp Co., 39 South Eighth street, has filed notice of organization to engage in the manufacture of lamps, etc. Ludwig Paslawski, 404 South Eleventh street, and John Skiba, 384 Walnut street, head the company.

Pompton Plains, N. J.—Tri-County Electric Co. is arranging plans for the construction of a new pole line through Pequannock Township and in the Riverdale section, a franchise having recently been granted by the Pequannock Township Committee.

Trenton, N. J.—Atlas Tire & Rubber Co., West State street, has recently commenced the construction of a new one-story factory and boiler plant on Enterprise avenue, to provide for increased operations. The structure will be about 90x370 ft., and is estimated to cost $100,000. H. Ludeke is president.

Trenton, N. J.—Trenton & Mercer County Traction Corp. has entered into an agreement with the City to make various improvements and alterations throughout different sections of its system.

Trenton, N. J.—Until June 25 bids will be received by the Department of Architecture, 142 West State street, for electrical work in connection with the proposed construction of a psychopathic Building at the New Jersey State Hospital, Trenton. Francis H. Bent is State Architect.

Reading, Pa.—Philadelphia & Reading Railroad Co., Philadelphia, has had plans prepared for the construction of a new one-story, brick, steel, and concrete power plant at its local properties, about 38x50 ft., to provide for increased capacity.

Upper Darby, Pa.—Philadelphia & Western Railway Co. is offering for sale a fully equipped power plant, at present in operation, of 4000-kw. rated capacity, generated through two Curtis vertical turbogenerators of 2000-kw. capacity each. The plant is supplied with superheaters, boilers, transformers, rotary converters, with auxiliary apparatus, and is situated within a few miles of Philadelphia.

Baltimore, Md.—Plans are being prepared by the Church Home and Infirmary, Broadway and Fairmount avenue, for the construction of a new three-story brick power plant. Wyatt & Nolting, Keyser Building, Baltimore, are architects.

Salisbury, Md.—Eastern Shore Gas & Electric Co., a Delaware incorporation, has filed notice with the Secretary of State of an increase in its capitalization from $750,000 to $1,150,000, to provide for general business expansion.

Martinsburg, W. Va.—Potomac Light & Power Co. is understood to be arranging plans for the reconstruction of its local substation recently destroyed by fire, with loss estimated at $12,000.

Spencer, W. Va.—The city will construct one-story brick electric light plant building. Address R. C. Wieland, mayor.

Cornelius, N. C.—Contract has been awarded by the city to C. F. Asbury, Charlotte, for the construction of a new municipal transmission system, to include the installation of transformer equipment at point of connection with the system of the Southern Power Co., which will supply electric energy for operation. J. B. Readling is Mayor.

Augusta, Ga.—The special council committee on the municipal lighting and power plant project will meet with the finance committee for a conference relative to arriving at definite financial estimates on installing the system. It is estimated that the plant can be in full operation to furnish light and power for the entire city at a cost not to exceed $250,000.

Dalton, Ga.—Georgia Railway & Power Co., Atlanta, Ga., will install loop at power station here at a cost of $6000.

McDonough, Ga.—Dr. A. R. Scott contemplates developing waterpower at Peachstone schools and furnishing electricity for lighting and power to Locust Grove and Stockbridge.

Kissimmee, Fla.—Contract has been awarded to W. H. Arnold, of this city to install power, light and refrigerating plants at Kisco for the Kissimmee Cattle Co. to replace the plants that were burned.

NORTH CENTRAL STATES.

Dayton, Ohio.—Dayton Power & Light Co. asked the State Public Utilities Commission for permission to issue $232,000 6% par value bonds. Address general manager.

Dayton, Ohio.—Plans have been announced by C. A. Kurz of the Dayton Insulating Die Co. and the Dayton, Oxygen & Hydrogen Products Co. for the erection of a modern two-story factory building.

Sandusky, Ohio.—One-half million dollars has been subscribed by Sandusky capital to manufacture and place upon the market motor-driven cultivators. This is a new product designed by a Sandusky man. The motor cultivator is 1½ hp., and will operate at a speed of about 1½ miles per hour. The tank contains one gallon of gasoline, which is sufficient to operate the machine for five hours. This company is well financed, and is one of the bright spots in Sandusky's new industrial development.

Decatur, Ind.—Charles N. Christen has taken the contract for erecting the new building of the Old Adams County Bank for $27,645. The building will cost, with vaults and equipment, about $60,000.

Fort Wayne, Ind.—Home Telephone & Telegraph Co. will install extensive new equipment, especially switchboard equipment.

Gary, Ind.—Construction on the first unit of the Gary Tube Works will be commenced July 1. The first unit of the plant will cost approximately $25,000 000 and will consist of four blast furnaces, three Bessemer converters, blooming mills, plate mills, tube mills and soaking pits. Approximately $1,000,000 has already been

DATES AHEAD.

New York State Association of Electrical Contractors and Dealers. Annual convention, Saratoga Springs, June 23-26. Headquarters, Grand Union Hotel. Secretary, J. P. Ryan, 26 Cortland street, New York City.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 24-27. Headquarters, Hotel Traymore. Secretary, University of Pennsylvania.

American Institute of Electrical Engineers. Annual convention, Lake Placid, N. Y., June 24-27. Headquarters, Lake Placid Club. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

Canadian Electrical Association (affiliated with N. E. L. A.). Annual meeting, Alexandria Bay, N. Y., June 27 and 28. Secretary-treasurer, W. Volkman, Toronto Power Co., Toronto, Ont., Can.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., October. General secretary, Clarence L. Law, 29 West 39th street, New York City.

expended in building concrete docks and foundations for the ore unloaders. As soon as the first unit is completed it is planned to begin the second unit. When entirely completed, which will be in about three years, the plant will employ 15,000 men. The plant will cover 800 acres, extending along Lake Michigan immediately east of the Gary Harbor for a mile and a half.

Indianapolis, Ind.—Home Elevator Co. will erect new factory building. 100x150 ft., one story, to cost $20,000. An electric crane will be installed to travel the length of the building to lift and place heavy machinery, which will cost $20,000 additional.

Indianapolis, Ind.—Mayor Charles W. Jewett announces that a bond issue will be floated in the fall to finance the erection of a new coliseum, which will cost, when completed, from $2,500,000 to $3,000,000.

Jeffersonville, Ind. — Plans have been practically completed for additional permanent improvements at the Government Depot, to cost more than $100,000. Under the new arrangement the power house will be erected outside of the main enclosure.

Mishawaka, Ind.—The new building of the Central Union Telephone Co. will be ready for occupancy July 25. Thirty men from the Western Electric Co. are at work putting in the new switch while a force of men under the direction of E. W. Lindsey of Indianapolis are laying the underground and aerial cables. The building is complete in every respect. Wilfrid Dudding is local manager of the Central Union Telephone Co.

North Vernon, Ind.—Sanborn Electric Co. of Indianapolis will do the electrical wiring for the Jennings County Library for $1370. The State Construction Co. of Indianapolis has been awarded the contract for the construction of the building on its bid of $15,600.

Bloomington, Ill.—LaFayette Co. will erect $250,000 apartment building. The building will be eight stories in height and will contain 56 apartments.

Chicago, Ill.—The Board of Education plans to expend $7,000,000 during the year for the erection of a number of elementary schools and a high school. This work will require considerable electrical equipment.

Marion, Ill.—The city commissioners have under consideration the proposition to establish ornamental lighting.

Medora, Ill.—L. C. Hard, the owner of the Medora electric light plant, finds that there is not profit sufficient to justify his running the plant, so he has made a proposition to the village board to sell the entire outfit for $3000. The board has taken the matter under advisement.

Springfield, Ill.—St. John's Hospital Tuberculosis Sanitarium near Riverton will have a three story brick addition to cost $31,000.

Springfield, Ill.—The Illinois Public Utilities Commission has entered an order authorizing the Mississippi River Power Co. to issue and dispose of $105,000 promissory notes. The Commission has also allowed the Keokuk Electric Co. to issue and dispose of $43,500 promissory notes.

Springfield, Ill.—New state militia armories will be erected at Joliet and Elgin, each to cost $51,000.

Springfield, Ill.—An electric line is planned from Springfield to Davenport, Iowa. Address William H. Conklin, secretary of the commercial association.

Urbana, Ill.—One contract for ornamental lighting has been let. Ornamental lights for the entire western part of the city is contemplated in the near future. Address clerk of board.

Adrian, Mich.—United Electric Manufacturing Co. will build a one-story plant to cost between $75,000 and $100,000.

Detroit, Mich.—July 22 is the date of the special election when the voters of the city will be asked to appropriate issuance of public utility bonds not in excess of $10,000,000 for the building, operation and maintenance of a municipal street railway system. Address city comptroller.

Black River Falls, Wis.—The City Council is planning improvements to the municipal hydroelectric plant, to cost $25,000, including a vertical type waterwheel and 400-hp. umbrella type generator.

Manitowoc, Wis. — Manitowoc & Northern Tractor Co. has been ordered by the Council to extend street railway lines.

Merrimack, Wis.—Merrimack Electric Light Co. is contemplating installing an electric lighting system to supply electricity here.

Stoughton, Wis.—Stoughton Wagon Co. is planning to install a 400-kw. steam-driven generating unit to replace a 150-kw. unit now in use.

Geneva, Minn.—The city contemplates building an electric light plant. Address Carl Knudson, clerk.

Minneapolis, Minn.—The sales department of the Minneapolis General Electric Co. during the week ended June 6 secured 527 new electric light and power customers with 322 kw. of lighting and 798 hp. in motors. New business connected to the company's lines includes 107 customers with 56 kw. of lighting and 456 hp. in motors. Contract has been secured with the Minneapolis Brick & Supply Co. covering 80 hp. in motors, and connection has been made for the requirements of the Dyckman Hotel amounting to 600 hp. Output of electric energy was 30.5% greater than for the corresponding period a week ago.

Davenport, Iowa.—Palmer School of Chiropractic Science will build four story fireproof structure, 125x60 ft., steel and concrete construction.

Davenport, Iowa.—Wilson & Co. will rebuild the old refining hardening plant at Bettendorf, which was destroyed by fire a few days ago.

Deep River, Iowa.—The local light and water plant was damaged by an explosion and fire, caused by the blowing up of the boiler. W. J. Forby, city electrician, was injured but not fatally.

Dubuque, Ia.—Keller Electric Co. has refurnished its salesrooms, the new appointments making this retail store one of the most elaborate and inviting in the Central West.

Marshalltown, Iowa. — Hoggson Brothers will erect $100,000 bank building for the Marshalltown State Bank.

Newton, Iowa.—A special election will be held June 30 to determine whether the Des Moines Electric Co. shall furnish electricity to the city of Newton, on an eight-year contract..

Traer, Iowa.—An election will be held in July to vote on the question of issuing $50,000 municipal light bonds.

Kansas City, Mo.—Morris & Co., Chicago, contemplate increasing the output of its local power plant.

St. Joseph, Mo.—Utz & Fitzpatrick, manufacturers of electric batteries, are considering plans for the erection of a new brick battery building, to cost about $10,000.

Hiawatha, Kans.—The city is preparing plans for improving the water works system. Plans include the installation of pumps at spring on county farm, etc. About $25,000 will be expended. Black & Veatch, Interstate building, Kansas City, Mo., engineers.

Hutchinson, Kans. — Partridge, Langdon, Arlington and Turon will soon vote bonds to pay for the construction of an electric transmission line and installing light plants in those towns. Arrangements are being made with the United Water, Gas & Electric Co. of Hutchinson to furnish the power for the four municipalities, similar to the arrangements by which the current is furnished to Nickerson, Lyons and elsewhere.

Manhattan (Rocky Ford), Kans.—Fire destroyed the power plant of the Rocky Ford Milling & Power Co.'s plant six miles north of this city. The loss is estimated at $150,000. It is one of a system of plants which include those supplying Abilene, Blue Rapids, Junction City and other small towns. Plans are already under way for the building of a new plant as soon as equipment is available.

SOUTH CENTRAL STATES.

Louisville, Ky.—The commercial department of the Louisville Gas & Electric Co. during the week ended June 6 secured 59 new electric light and power customers with 64 kw. of lighting and 214 hp. in motors, and took contracts for wiring 11 already built houses. New business connected to the company's lines shows an increase of 57 customers with 31 kw. of lighting and 64 hp. in motors. Electric energy output shows a gain of 7.4% over last year. Within the next year Louisville will be in the midst of the biggest building boom. Buildings estimated to cost more than $3,500,000 are under way and planned, including an eight-story office building for the Belknap Hardware & Manufacturing Co., two large apartment houses, annexes to two of the largest office buildings in the city and several warehouse jobs.

Coldwater, Miss.—City Commission has completed arrangements for the installation of a new electric street lighting system and the construction of a transmission system extending to Senatobia, the latter municipality furnishing electric energy for operation. Bonds for $10,000 have been voted for the proposed work, and it is understood that the City Council, Senatobia, is arranging plans to enlarge its electric plant for the increased service.

Yazoo City, Miss.—The city proposes to increase and improve its electric lighting facilities. Address city engineer.

Nachitoches, La.—The city contemplates remodeling its water and electric power plant and to install sewer system. Address mayor.

New Orleans, La.—American Sugar Refining Co. is planning to remodel its power plant and install new dynamos and machinery.

La Fayette, Tenn.—The city plans the installation of an electric lighting system. Address the mayor.

Nashville, Tenn.—The city will expend $48,000 improving electric light system. Address J. W. Dashiel, commissioner.

Brownsville, Tex.—The municipal electric light and power plant here is to be equipped with a new 500-kw. turbogenerator and condensing apparatus for the new units. The proposed improvements will cost about $27,000.

Dallas, Tex.—Dallas Power & Light Co. has purchased the electric light and power plant of the Dallas Ice Factory & Light Co. The consideration was $210,000. New equipment will be installed in the plant.

Houston, Tex.—According to H. A. Havelton of this city, president of the Houston, Richmond & San Antonio Traction Company, the project of constructing an interurban electric railway between Houston and San Antonio, about 225 miles, has been financed by Eastern interests. Right of way for the proposed line is now being obtained. Cash bonuses in aid of the project, aggregating about $600,000, have been raised in the different towns along the route.

Mexia, Tex.—An electric power plant is to be installed, representing an investment of about $150,000, to supply the nearby towns of Thornton, Cooledge and Groesbeck with electric power. New machinery has been purchased and delivered.

WESTERN STATES.

Pine Bluff, Wyo.—Bonds in the sum of $40,000 have been voted for extensions to the electric light plant, water mains and sewers.

Idaho Falls, Idaho.—An issue of water and light bonds to the amount of $35,000 was voted at a recent election.

Salem, Ore.—Application covering two projects to cost an aggregate of $1,550,000 along the Clackamas river were filed with the State Engineering Department. The Clackamas Power & Irrigation Co. filed application to use 1000 second-feet of water from the Clackamas river to develop 11,705 hp. near Estacada. The proposed project will cost $1,250,000. A fall of 300 feet will be utilized and a ditch and flume 6.6 miles long and a dam 400 ft. long will be built. At the same time application was filed by the Portland Railway, Light & Power Company for the storage of 40,400 acre feet of water from Oak Grove creek to develop power along the Clackamas river. The cost of the storage reservoir is estimated at $300,000.

Seattle, Wash.—J. D. Ross, superintendent of the city lighting department, has filed a communication with the City Council, urging appropriation of $764,360 to add a third unit to the Lake Union steam plant, adding 15,000 kw. to its capacity.

Seattle, Wash.—Negotiations are pending between the city and Puget Sound Traction, Light & Power Co., for the use by the city of the traction company's surplus electric power. Address J. D. Ross, superintendent of the municipal light and power department.

Fresno, Cal.—San Joaquin Light & Power Co. has inaugurated preliminary work on the proposed hydroelectric power plant near Big Sandy, in the vicinity of Auberry. It is estimated to cost about $2,000,000, including equipment.

Los Angeles, Cal.—An election will be held to vote on the issuance of power plant bonds to the amount of $13,500,000.

CANADA.

Boston Creek, Ont.—Northern Ontario Light & Power Co. will erect an electric substation here at an estimated cost of $7000. The company is in the market for material and equipment.

Fort Erie, Ont.—International Safe Co. is in the market for a portable electric drill with 7/16 in. chuck, portable electric grinders, power gap shears for ⅛ in. stock power punch press, weight about 5000 lb.; tool room lathe, 22-in. planer, 4-ft. over all; electric spot welder, tool room forge, 10-hp. motor, three-phase, 220 volts, 25 cycle.

South Temiskaming, Que.—Kipawa Fibre Co. is making rapid progress on the erection of its plant at Lumsden's Mills. Work has been started on the erection of a power plant which will develop approximately 20,000 hp.

Toronto, Ont.—Consolidated Stamping & Enameling Co. will install three furnaces and two smelters in connection with its plant.

Marysville, N. B.—The Town Council contemplates the installation of a new lighting system.

Toronto, Ont.—A resolution has recently been passed by 300 representatives of Ontario municipalities, requesting the government to turn over to the hydroelectric commission for electrification the branch lines of the Grand Trunk Railway and the Canadian Northern Railway in the province.

Windsor, Ont.—The City Council has under consideration the erection of a power house.

Roberval, Que.—The municipal council will make repairs to the hydroelectric plant to cost $20,000, and is in the market for one horizontal shaft turbine, 300 hp., head 50 ft., speed 600 r.p.m, also one 250-kv-a., alternating current generator, exciter switchboard, etc. J. F. Trenton, Chicoutimi, Que., is engineer.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Motor Driven Knitting Machine. (29,509).—A person in Uruguay wishes to purchase a knitting machine for cotton and woolen knit goods, to be driven by electric motor and installed in room 19½ ft. long. An illustration of a machine similar to the one desired was forwarded and may be seen at the bureau or its district offices. (Refer to No. 114,478). Quotations should be given f. o. b. New York. Terms, sight draft against documents. Correspondence should be in Spanish. References.

Electrical Supplies (29,494).—The purchase of machinery, electrical supplies, lighting appliances, rubber and rubber goods, etc., are required by a firm in Norway. Payment against documents at destination. References.

X-ray Apparatus. (29,665).—X-ray apparatus for electromedical uses is desired by a man in Switzerland. Correspondence may be in English. References.

Machinery for Manufacturing Insulators (29,666).—The purchase of machinery for the manufacture of porcelain insulators is required by a manufacturer in Brazil. Specifications of the machinery required and illustrations of the articles to be manufacured were forwarded and may be examined at the Bureau or its district offices. Correspondence should be in Portuguese, Spanish or French. References.

Generators and Electrical Material (29,632).—A man in Italy desires to represent American manufacturers and exporters in gasoline engines for motor cars, electric generators, and other electrical material. References.

Electrical Goods (29,663).—A company in England, having recently established an office in this country, desires to communicate with manufacturers of machinery, electrical goods, motor cars, etc. Reference.

Electrical Accessories and Pumping Sets (29,653).—Electric light sets and electrical accessories, lamps, fans, etc.; pumping sets and household requisites of a general character, etc., are required by a firm in India. General catalogs are requested.

Traveling Cranes, Motors, Electrical Material (26,656.—A firm in Belgium desires to purchase or act as agent or receiver on consignment of tramway equipment, traveling cranes, electrical material, motors, illuminat-

ing and insulating material, and telephone and other special equipment. Reference.

Electrical Goods, (29,625).—A firm in Italy wishes to secure an agency for the sale of machinery, accessories, electrical goods, and construction materials. Correspondence may be in English. References.

Electric Lamps, (29,626).—A person in Spain desires to secure an agency for fertilizers, cotton, electric lamps, photographic apparatus, etc. Correspondence should be in Spanish. References.

Wire Rope, Motors (29,611).—The purchase of supplies for logging and floating, all kinds of supplies for logging, such as wire rope, tree-felling machines, motors, stump pullers, and all necessary supplies to be used in forestry, is required by a company of sawmill owners. Quotations should be given f. o. b. American port. Payment, cash. Reference.

Electrical Machinery (29,617).—The purchase and agency for electrical machinery, motors, copper wire and cable; vehicles, office supplies and appurtenances, etc., are required by a firm in Norway. Terms, cash against documents. Reference.

Electrical Materials (29,575).—An electrical supply dealer in Switzerland wishes to be placed in touch with manufacturers of electrical material in this country, such as small motors for sewing machines, special electrical material for electrical railways, electric heating and cooking apparatus, and porcelain fittings and insulators for high and low tension. Reference.

Electrical Supplies (29,556).—A trading firm in Esthonia desires to receive quotations on hardware and tools for carpenters, blacksmiths, etc., machinery and tools for metal and woodworking industry and for working iron sheets, electrical supplies, etc. Catalogs and samples are requested. Reference.

Dynamos, Transformers, Motors, Etc. (29,567).—The purchase and agency are desired by a man in Italy of dynamos, motors, transformers, and all electrical equipment and accessories. Payment, cash. Correspondence may be in English. Reference.

Pumps, Motors, Etc. (29,574).—The purchase of pumps, motors and vending machines is desired by a firm in Portugal. Correspondence should be in Portuguese. References.

PROPOSALS

Generators, Transformers, etc.—Bids will be received by the Board of Public Service, Knickerbocker building, Los Angeles, Cal., until 3 p. m., June 27, for electric generators, transformers, auxiliary electrical equipment and apparatus, and hydraulic equipment for the municipal electric power plants. James P. Vroman, secretary.

Electric Light Fixtures.—The School Board, Fargo, N. D., will receive bids July 2 for the following supplies: Clocks, bells, telephones, fire alarm system and electric light fixtures. Address E. G. Guthrie, secretary.

Electric Generator Units.—R. M. Mulligan, Commissioner of School Buildings, St. Louis, Mo., is receiving bids for furnishing and installing five electric generator units in St. Louis high schools; three units to be three-phase, alternating current motor drive, 125 hp. at 40 rating; two units to be three-phase, alternating current motor drive, 100 hp. at 40 rating; motors to be three-phase, 60-cycle, 222 volt wound rotor with slip rings having a synchronous speed of 900 r. p. m. and loaded capacity speed of 885 r.p.m. The belting is to be of endless and high grade double oak tanned leather with a short lap of not less than 12 in. wide. Pulleys to be regulation Rockwood paper pulleys, heavy duty, two minute starting drum.

INCORPORATIONS

South Bend, Ind.—South Bend Electric Co. has incorporated with a capital of $100,000 and will handle telephone and electric supplies. J. D. Meek, director.

Muncie, Ind.—Steroelectric Co. has been incorporated with capital of $50,000 to deal in electric supplies. Address J. L. Moore, Muncie, Ind.

Eastland, Tex.—Eastland Gas & Electric Co. has been incorporated here with a capital of $50,000. It will construct an electric light and power plant. The incorporators are H. P. Brelsford, J. H. Cheatham and G. E. Potts, all of Eastland.

Evansville, Ind.—American Lamp & Specialty Co. has been incorporated with capital of $30,000. Address James H. Powers, Evansville, Ind.

New York, N. Y.—Shimel-Bayer Co. Capital, $20,000. To manufacture electrical supplies. Incorporators: L. and J. Shimel, and L. Bayer, 83 West 118th street.

Fresh Pond, L. I., N. Y.—Fresh Pond Electric Co. Capital, $10,000. To manufacture electrical goods. Incorporators: P. F. Brien, J. Kreuser, and P. R. Schoening, 718 Halsey street, Brooklyn.

New York, N. Y.—Upper Hudson Utilities Corp. Capital $889,500. To engage in the distribution of light, heat and power in Warren County. R. D. Rediefsen, G. Tiernan, and J. B. Purcell, 51 West 130th street.

Salamanca, N. Y.—Standard-Marvel Co. Capital, $10,000. To manufacture heating and vacuum cleaning systems. Incorporators: D. J., N. S., and E. Y. Kilby, Salamanca.

Rochester, N. Y.—Schiefer Electric Co. Capital, $35,000. To manufacture electrical specialties. Incorporators: F. L., H. J., and H. J. Schiefer, Jr., Rochester.

Newark, N. J. — Foster-Reinhold Laboratories. Capital, $100,000. To manufacture storage batteries. Incorporators: Walter Drew, Robert J. Foster, and Worthington Campbell.

Waterbury, Conn.—Gordon Electric Manufacturing Co. Capital, $52,600. To manufacture electrical goods. Incorporators: Ira R. Seltzer; A. H. Post, and H. M. Valcourt.

Wynona, Okla. — Wynona Public Service & Manufacturing Co. Capital, $30,000. To operate a local electric light and power company. Earl Chowins is the principal incorporator.

Eastland, Tex.—Eastland Electric & Gas Co. Capital, $50,000. To operate a local electric and gas plant. H. P. Brelsford is the principal incorporator.

Spencer, Ohio.—Spencer Light & Power Co. has incorporated with a capital of $40,000 by George B. Bonthinon and others.

Peoria, Ill.—Bliss Battery Corp. has filed incorporation papers to manufacture electrical storage batteries, appliances and plants. Address George E. Cummings, Peoria, Ill.

Louisville, Ky.—Federal Electric Co. has been incorporated by John G. Parker to conduct a general electric business.

New York, N. Y.—Martalex Manufacturing Co. Capital, $10,000. To manufacture electrical devices, etc. Incorporators: A. Ascher, M. Fogel, and A. Kutz, 320 Broadway.

Helena, Mont.—Drummond Light & Power Co. has been incorporated for $50,000 by H. H. Hansen and associates.

South Bend, Ind. — South Bend Electric Co. has been incorporated with capital of $100,000 to engage in the handling of electric and telephone supplies. Those interested are R. P. Oblinger, H. E. Rasmusson and J. D. Meek.

Louisville, Ky.—Federal Electric Co. has incorporated with a capital of $1,000 by John G. Parker, John Wilhoyte and R. A. McDowell.

Rock Island, Ill.—Phelps Light & Power Co., a Delaware company, has been incorporated to transact business in Illinois for the purpose of manufacturing farm light and power plants. The capital stock is $800,000, of which amount $400,000 is to be employed in the business in Illinois. The principal office will be Sixth avenue and First street, Rock Island, Ill. The incorporators are R. T. Phelps, Rock Island, Ill.; A. G. Bush, Davenport, Ia.; and W. J. Moore, Tipton, Ia.

Oswego, N. Y.—Waring Motor Cultivator, Inc. Capital, $125,000. To manufacture motor machinery, motor power cultivators, etc. Incorporators: H. E. Moyses and C. F. McDonald, New York; and L. Quinlan, Oswego.

Jersey City, N. J.—Jo-So Mo-Tor Co. Capital, $125,000. To manufacture combustible engines, etc. Incorporators: Philip Niedemaier, J. C. and C. S. Soeman, Newark.

Newark, N. J.—New Land Lamp Co. Capital, $100,000. To manufacture electric lamps, etc. Incorporators: R. J. Farese, Nicholas Striglia, and M. Bonito, Newark.

Personal

English Distinguished Service Order Awarded Col. Byllesby —E. A. Hitchcock New Vice-President of Bailey Meter

HENRY BREWER has been placed in charge of pyrometer sales and service department established at 1304 Monadnock Block, Chicago, by the Leeds & Northrup Co., Philadelphia, Pa.

DR. ALFRED N. GOLDSMITH, professor in charge of electrical engineering, College of the City of New York, was recently appointed director of research of the Marconi Wireless Telegraph Co. of America.

RALPH B. PHILLIPS, of Brookline, Mass., has again secured control of the American Steam Gage & Valve Manufacturing Co., Boston, and succeeds his father-in-law, John McCandish, as president.

W. HERBERT TEES, formerly superintendent of the Sayer Electric Co., and electrical engineer of the Canadian Consolidated Rubber System, Montreal, has joined the sales department of the Willys-Overland Co.

JOHN FISHER, formerly chief engineer, Hartford district of the Connecticut Co., Hartford, Conn., has accepted the appointment as chief engineer of the Quincy Point power station of the Bay State Street Railway Co., Quincy, Mass.

J. R. MCCOY, who has been associated with the new business department of the Columbus Railway, Power & Light Co. for many years, has left for Dallas, Tex., to assume the position of head of the new business department of an electric light company in that city.

FRANK D. SHUMATE, for a number of years Chicago manager of the Worthington Pump & Machinery Co., has been elected vice-president and general sales manager of the Chalmers Pump & Manufacturing Co., Lima, Ohio, formerly the Chalmers Manufacturing Co.

GLENN VAN AUKEN, of Auburn, Ind., has been named a member of the Indiana Public Service commission to succeed Edwin Corr of Bloomington, Ind. Mr. Van Auken is an attorney and has served in the Indiana state senate. During the war period he was an instructor in musketry fire and was stationed at Camp Perry, Ohio. As a member of the Indiana National Guard he saw service on the Mexican border.

E. BURT FENTON, for the past two years publicity agent of the Northern Ohio Traction & Light Co., with headquarters at Akron, Ohio, has resigned that position. He was formerly publicity manager of the W. S. Barstow & Co. properties and for some years past has specialized on matters pertaining to the public relations of utilities. Mr. Fenton is the author of several papers and magazine articles on this subject which have attracted wide attention and received favorable comment. His future connection is not announced.

TOM L. GREEN, consulting engineer, has opened offices at both Miami and Oklahoma City, Okla., with an efficient staff. Mr. Green desires catalogs and bulletins descriptive of equipment and materials used in the construction of water works, sewers, sewage disposal plants, water filtration plants, electric light and power systems, etc.

WALTER W. VAN HORN, general manager of the Shelby Lamp Division of National Lamp Works, has resigned in order that he may engage actively in another line of business in which he is financially interested. Mr. Van Horn's long connection with the lamp business, both in the manufacturing and selling, has gained him a wide circle of friends who will miss their association with him. He will be succeeded by Clifford C. Skiles.

E. A. HITCHCOCK, for the past six years affiliated with the E. W. Clark & Co. Management Corp. as advisory, consulting and power sales engineer, was recently elected vice-president of the Bailey Meter Co., Cleveland, Ohio. He will supervise the training of technical graduates for the company's service and sales departments. Previous to his connection with the Clark company, Mr. Hitchcock was professor of experimental engineering at Ohio State University.

O. D. CONOVER, formerly vice-president and chief engineer of the T. W. Price Engineering Co., New York and Chicago, and production manager of the Ludlum Electric Furnace Corp., has tendered his resignation to become production and sales engineer on foundries and steel plants of the Austin Co., Cleveland, Ohio. Mr. Conover has had an extensive experience as engineer in charge of the design and construction of a large number of steel plants, foundries, electric furnaces and other equipment in both this country and abroad. One operation on which he served as resident engineer for the T. W. Price company was the plant of the Ludlum Steel Corp. at Watervliet, N. Y., the plant having been erected by the Austin Co. Mr. Conover will establish his headquarters at the Cleveland office of the company.

LIEUT.-COL. HENRY M. BYLLESBY, president of H. M. Byllesby & Co., who served as purchasing agent for Great Britain and Scandinavian countries for the American Expeditionary Forces, with headquarters in London, has just been advised that the English Distinguished Service Order has been conferred upon him. The Minister of Munitions of the British Government, in advising Colonel Byllesby writes as follows: "I have just learnt with great satisfaction that the King has approved of the award to you of the Distinguished Service Order, a much coveted distinction of which any officer may be proud. From the moment of your arrival in Great Britain you made it quite clear that you were determined to carry on and largely extend the assistance rendered to my department by your organization, and throughout the whole period of our co-operation with you our personal relations have been of the most cordial character. Please accept my warm congratulations on this well deserved recognition of the great work you have done."

SAM T. WHITE, president of the White-Lily Mfg. Co., is said to be the first man that ever placed a motor in a washing machine. After endeavoring unsuccessfully, to interest manufacturers of motors in the feasibility of the idea, Mr. White undertook to install a motor in a washing machine on his own responsibility. His first installation—probably the first in history—was made in Kansas City, Mo., in 1904. That the idea of driving washing machines by electricity was one of practical value is indicated by the fact that $25,000,000 worth of electrically driven washing machines were sold during 1918.

Obituary.

WINFIELD SCOTT GORDON, Bay Ridge, Brooklyn, N. Y., connected with the New York Electric Light Co., New York, for the past 30 years, died on June 5, at his home, 511 77th street, following an attack of heart disease. Mr. Gordon was in his fifty-fifth year.

PAUL M. EINERT, aged fifty-six years, died suddenly June 5, at his home, 220 West 98th street, New York City. Mr. Einert entered the accounting department of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh in 1900. One year later he was sent to Havre, France, to take charge of the accounting department of the French Westinghouse Co. From there he was transferred, about 1905, to the British Westinghouse Electric & Manufacturing Co., Ltd., at Manchester, England, to take charge of the accounting department of that company. In 1910, Mr. Einert was appointed foreign auditor of the Westinghouse company, with headquarters in London. After the purchase of the controlling interest in the French and Italian companies by the British Westinghouse Co. from the Westinghouse Electric & Manufacturing Co., Mr. Einert returned to service with the British company as its traveling auditor, holding that position until the latter part of 1916, when he returned to this country as assistant to the comptroller of the Westinghouse company with offices at East Pittsburgh. In January of this year he was appointed special representative to the chairman, with offices in New York, his chief duties being in connection with foreign trade of his company, in which capacity he served until his death.

Financial News

Financial Position of European Countries.

Discussing the present financial position of Europe, American Goods and Foreign Markets, the semi-monthly review of export trade conditions of the Guaranty Trust Co. of New York, says, in its current issue:

"There has recently been comment intended to show that the demoralization caused by four and one-half years of war was more wide-spread and more profound than we had known, and that European countries were recovering their stability and their productivity more slowly than might have been expected. Such a view fails to take into consideration the tremendous nature of the burden assumed by the Allied nations when they set out to win the war, nor does it remember that the changed economic conditions which the war has brought about mean a remoulding of the whole financial structure of Europe. Until the foundations have been laid the work that has already been done will not clearly show itself And until the foundations have been laid, also, it will be impossible for the manufacturers and merchants to make their plans for the future. The fundamental problems, however, are being attacked and solved. Only a few days ago the dispatches brought word of the new and more exacting taxation schemes of both the French and Italian Governments. Upon this news there was an immediate improvement in the exchange situation with regard to both countries. The boldness of those who proposed and adopted these new laws indicate not only the strength of the governments which they represent, but also the popular understanding of the seriousness of the situation, and the willingness to shoulder the responsibility for the only measures which can save it."

Resumption in Europe of production on the pre-war scale will not serve to drive the United States from its position as one of the leading export nations, the review says:

"However abnormal may be the present sale abroad of the goods of the United States, it is an abnormality which will probably continue for some little time; and readjustment, when it does come will not restore pre-war conditions. The economic changes which the war has brought about will not be obliterated by a resumption of full-scale production by the industries of Europe. A large American export trade is a definite and continuing factor in the world's affairs."

Concerning the present great preponderance of exports over imports, and the probable reversal of the figures through extensive American investment in foreign securities, the review says:

"It is quite possible, that, what with the great payments already due us, and the increasing flow of goods resulting from our investments, the imports of the United States would ultimately be greater than the exports, unless a tariff barrier were placed to make it better, from a financial point of view, to reinvest the earnings of our investment in the countries of their origin, rather than to accept payment in goods.

"Barring such a possibility, the preponderance of imports over exports could not but be regarded as an evidence of strength, rather than weakness. It would mean that this country had achieved the position occupied by Great Britain before the war. Ships from all parts of the globe carried goods to the British Isles, returning with products whose value totaled far less The difference, of course, was made up in dividend payments, and were the return on capital invested by the British over a long period of years. The same thing was true of France and several other countries wherein foreign investment was accepted as the financial policy of the people. In such cases it is necessary to distinguish between the so-called trade balance, and the actual financial balance, which includes not only goods, but all values."

Wheeling Electric Stock Offered to Customers.

The Wheeling Electric Co. is offering to its customers a limited amount of its 6% cumulative preferred stock, the proceeds of which are to be used in making extensions and improvements to the property. This stock is offered upon a cash plan and upon a very liberal time plan as follows: First, cash payment $90 per share, plus accrued dividend to date of payment for stock and, second, time payment plan, $90 per share, plus accrued dividend, $10 per share payable monthly. If at any time before final payment is made on the partial payment plan, purchasers desire to cancel their subscriptions, all money paid in full will be refunded on ten days' notice, together with interest on such payment at the rate of 5% per annum.

The company is exceedingly anxious to have as large a number as possible of its customers become stockholders in the Wheeling Electric Co., in fact, it desires that every customer have a financial interest in the company, if only to the extent of owning one share. It is for this reason that the stock is being offered on the very liberal time payment plan. This stock is exempt from West Virginia state personal tax and the dividends are free from Federal normal income tax, making the actual net return 6.66% to the investor.

Expansion Standard Gas & Electric

In connection with the annual printed report of Standard Gas & Electric Co. for 1918 just issue, President H. M. Byllesby presents an addenda describing the new oil, refinery and utility properties acquired by the company. He says:

"The directors announce the completion of negotiations which have been going forward for several months and which have resulted in the acquirement of a controlling interest by Standard Gas & Electric Co. in the Shaffer Oil & Refining Co., and the acquirement by your company of the business (excepting the banking department) heretofore operated under the style of H. M. Byllesby & Co., Inc.

"As a part of these transactions, the company has acquired a large interest of Appalachian Power Co., owning and operating two modern water power plants of 19,000-kw. installed capacity, and a modern steam turbine power house of 15,000-kw. capacity (now approaching completion) on the New River in Virginia. The total generating capacity of the three plants aggregates 34,000-kw., or approximately 45,000 hp. Also, the company has acquired, on a profitable basis, certain other utility interests, principally increasing its holdings in existing properties.

"The acquisition of the part of the business of H. M. Byllesby & Co. set forth, and of the controlling interest of Shaffer Oil & Refining Co., are effective as of January 1, 1919.

"The net results to the company by the completion of the foregoing transactions, after accounting for all interest and dividend charges on securities issued or guaranteed in connection therewith and computed solely upon the elapsed earnings of the interests and securities acquired, plus the elapsed income of Standard Gas & Electric Co., are sufficient to pay the full 8% per annum dividend upon the outstanding preferred stock and to leave an immediate balance equivalent to a substantial dividend upon the common stock of the company.

"The large elapsed earnings of the acquired interests and the substantial amount of cash (in excess of $4,000,000) provided for the immediate development of the already extensive operations and proven acreage of the Shaffer Oil & Refining Co. justify the belief that the net income of Standard Gas & Electric Co. from this time forward will largely increase and be highly satisfactory.

"Shaffer Oil & Refining Co. (now being formed) succeeds to properties heretofore privately owned, which comprise a complete oil producing, refining and distributing property, together with over 500 tank cars and extensive pipe lines. The Shaffer interests are of long and well established reputation, large earnings, and possess the highest financial standing. The entire organization of the Shaffer interests remains with the new Shaffer company. C. B. Shaffer will be president of the Shaffer Oil & Refining Co. and H. M. Byllesby will be chairman of the board. Mr. Shaffer becomes a member of the board of Standard Gas & Electric Co.

The Shaffer interests, in addition to their present production in excess of 4,000 barrels per day, own approximately 57,000 acres of oil leases in the States of Oklahoma, Texas and Kansas.

"The financing required for the acquirement of these interests has all been underwritten.

"In consequence of the foregoing, and the excellent financial condition of the company and its greatly increased earnings, and the large addition to the value of its holdings, the directors declared a dividend of 2% upon the preferred stock of Standard Gas & Electric Co. for the quarter to end May 31, 1919, paid June 14 to shareholders of record at close of business May 31.

"The directors have appointed a committee to immediately formulate a plan for adoption by the board for the liquidation of the accumulated unpaid preferred stock dividends of Standard Gas & Electric Co., amount to approximately 13%."

The report for 1918, during which year the revenue of Standard Gas & Electric Co. was derived exclusively from investments in public utilities companies, shows that the subsidiaries withstood the war strain in a satisfactory manner. Gross earnings of subsidiaries totaled $23,344,286, or a gain of 20%, while net earnings were $8,849,861, a gain of 3.8%. The net income of Standard Gas & Electric Co. for 1918 was $1,574,927, compared with $1,566,051 in 1917. Dividends on the preferred stock were maintained at the rate of 6%, which rate has just been increased to an 8% basis.

President Byllesby says:

"Taking all factors into consideration it is a conservative assumption that a normal year, comparable to 1918 from the standpoint of volume of business, would have produced net earnings at least $1,500,000 greater than those of 1918 actually were.

"The subsidiaries derived their gross revenue in the proportion indicated, from the following sources: Electricity, 67.57%; gas, 25.68%; street railway, 3.65%; steam heat, 2.19%; telephone, .52%; water, .26%; ice, 13%.

"In no instance has anything been allowed to impair the high standard physical upkeep and operating efficiency of any of your subsidiaries. All properties have been fully and carefully maintained."

The policy of selling securities to customers was continued by subsidiaries during the year—resulting in 4,507 separate sales amounting to $2,315,600 par value.

Middle West Utilities Makes Good Showing.

The Middle West Utilities Co., one of the principal Insull holding companies, reports for the year ended April 30, 1919, net earnings equal to $7.20 a share on the preferred stock, as compared to $8.68 earned in the previous year.

The prospect is not so dun as these figures would suggest. Earnings, both gross and net, of the subsidiaries exceed those of the previous fiscal year. The parent company, however, permitted subsidiaries to retain ample funds and received in dividends a much smaller percentage of subsidiary earnings than in previous years.

Another optimism, not obvious, is the fact that of the $2,002,000 per annum increase in service rates granted by state and local authorities only 73½% appear in the income account just issued. At the close of April the annual rate of in-

For the Readjustment Period—What?

XLI.

Common Sense in Handling Export Trade

Are we not taking our foreign trade problems too seriously? Does it not seem that we are disposed to add to the actual difficulties of the case, others not really belonging but just thrown in gratuitously. We are properly impressed with our efficiency at home, but when we think of ourselves away from home we immediately begin to develop a case of "nerves." We discuss domestic trade and its difficulties in a perfectly rational manner and in a spirit of optimism and cheerfulness which leaves nothing to be desired. But when the subject of foreign trade is brought up we become serious all of a sudden. Long faces and corrugated brow effects are brought into the situation at once.

At home we are aggressive, cheerful and optimistic. A domestic trade problem to be treated is brought out into the open, attacked and solved. A perhaps not more difficult foreign trade problem is kept in a sort of special chamber of horrors. In the domestic field we seem to fear nothing; in the foreign field almost any element of difficulty suggested can become fearsome. In the domestic field we have full confidence in ourselves; in the foreign field we are prone to speak of the merits of the other fellow. We exaggerate the weaknesses of our own position and the advantages of the position of our foreign competitor. Foreign exchange, foreign markets, foreign business methods, foreign points of view, we are disposed to shroud in deep mystery, and to assume that they are well beyond the ken of the American business man.

G. A. O'REILLY.

This query by the Foreign Trade Representative of the Irving National Bank, New York, approaches the subject from a different angle than any to which we have been accustomed in discussing foreign trade. Nevertheless, it is pertinent and timely.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

creases granted amounted to more than the total net earnings of the year.

The income account for the period ended April 30 compares:

	1919.	1918.
Total income	$ 2,009,503	$ 1,955,210
Administration expense	179,890	194,921
Mis. charges, taxes, etc.	17,428	43,314
	$ 1,812,184	$ 1,716,974
Interest on notes and bonds	663,635	550,939
Interest on collateral loans, etc.	234,035	124,433
Net income	$ 914,513	$ 1,041,601

Earnings of subsidiary companies which were included in the income accounts of both years show a gain of 17.4%. The combined income account of all properties compare:

Gross earnings	$14,641,035	$12,157,121
Operating expenses including taxes	10,500,463	8,562,689
Net earnings from operation	$ 4,140,571	$ 3,594,432
Rentals on leased properties	258,230	222,909
	$ 3,882,341	$ 3,371,522
Special accruals		76,574
		$ 3,448,097
Bond, debentures and other interest charges paid or accruing to outside holders	$ 1,983,174	$ 1,715,189
Yearly amortization of discount on outstanding securities.	85,016	77,166
Dividends on stock and proportion of undistributed earnings to outside holders	420,478	389,971
Total earnings accruing to M. W. U. Co.	$ 1,393,672	$ 1,265,769

American Gas & Electric Declares May Dividends.

The American Gas & Electric Co. declared regular quarterly dividends of 1½% on the preferred and 2½% on the common stocks and an extra dividend of 25% and a special dividend of 2½% payable in common stock on the common stock. The preferred dividend is payable Aug. 1 to stock of record July 15, and the common July 1 to stock of record June 20. The extra dividend is payable July 1 to stock of record June 20 and the special dividend is payable Oct. 1 to stock of record June 20.

Dividends.

Mineola Electric Co. has declared a quarterly dividend of 1½%, payable July 1 to stock of record June 18.

A quarterly dividend of 1¼% on preferred stock has been declared by the Carolina Power & Light Co., payable July 1 to stockholders of record June 18.

Ingersoll-Rand Co. has declared the semi-annual dividend of 3% on preferred stock, payable July 1 to stock of record June 21.

Ottawa Traction Co. has declared a quarterly dividend of 1%, payable July 1 to stock of record June 15.

Western Electric Co. has declared a quarterly dividend of $2.50, also a quarterly dividend of $1.50 on preferred stock, payable June 30 to stockholders of record June 22.

Westinghouse Airbrake Co. has declared a quarterly dividend of $1.75, payable July 31 to stock of record July 3.

Canadian General Electric Co. has declared a quarterly dividend of 2%, payable July 1 to stock of record June 14.

Electric Storage Battery Co. has declared a quarterly dividend of 1%, also a quarterly dividend of 1% on preferred stock, both payable July 1 to stock of record June 16.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid June 10.	Bid June 17.
Adirondack Electric Power of Glens Falls, common	6	14	15
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	162	179
American Gas & Electric of New York, preferred	6	42	42
American Light & Traction of New York, common	..	269	265
American Light & Traction of New York, preferred	6	99	99
American Power & Light of New York, common	4	70	72
American Power & Light of New York, preferred	6	74	74
American Public Utilities of Grand Rapids, common	..	15	10
American Public Utilities of Grand Rapids, preferred	7	36	35
American Telephone & Telegraph of New York	..	106⅜	106¼
American Water Works & Elec. of New York, common	..	6	5½
American Water Works & Elec. of New York, particip	7	14	12
American Water Works & Elec. of New York, first preferred	..	61	60
Appalachian Power, common	..	5	4
Appalachian Power, preferred	7	16	12
Cities Service of New York, common	+extra	380	370
Cities Service of New York, preferred	6	80	79
Commonwealth Edison of Chicago	8	111½	111
Comm. Power, Railway & Light of Jackson, common	..	29	28
Comm. Power, Railway & Light of Jackson, preferred	6	63	64
Federal Light & Traction of New York, common	..	11½	11½
Federal Light & Traction of New York, preferred	..	47	47
Illinois Northern Utilities of Dixon	6	70	70
Middle West Utilities of Chicago, common	2+extra	36½	36
Middle West Utilities of Chicago, preferred	6	62	62
Northern States Power of Chicago, common	..	72	72
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	61	61½
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	92¼	90
Public Service of Northern Illinois, Chicago, preferred	6	92½	92
Republic Railway & Light of Youngstown, common	4	19	17
Republic Railway & Light of Youngstown, preferred	6	59	58
Standard Gas & Electric of Chicago, common	..	38	34
Standard Gas & Electric of Chicago, preferred	6	47	46
Tennessee Railway, Light & Power of Chattanooga, common	..	4½	6½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	20	20
United Light & Railways of Grand Rapids, common	4	49	49
United Light & Railways of Grand Rapids, preferred	6	73	74
Western Power of San Francisco, common	..	20	22
Western Union Telegraph of New York	extra	90¼	89⅜
Industries.			
Electric Storage of Philadelphia, common	4	72	82
General Electric of Schenectady	8	167¾	161½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	57⅜	57
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	57	57

Westinghouse Electric Export Co., 165 Broadway, has filed notice of an increase in its capital stock from $100,000 to $5,000,000, and a change in its corporate name to the Westinghouse International Co.

Earnings.

MISSISSIPPI RIVER POWER CO.

	1919.	1918.
For month of April—		
Gross earnings	$ 184,922	$ 193,233
Net earnings	139,677	157,462
Surplus after charges.	36,753	53,100
For 12 months ending April 30—		
Gross earnings	2,219,176	2,073,005
Net earnings	1,748,734	1,668,775
Surplus after charges.	503,742	437,516

CITIES SERVICE CO.

For the 12 months to April 30—Gross, $21,913,980, increase $1,786,264; net, $21,285,187, increase $1,537,472; surplus after charges, $20,412,334, increase $667,254. April gross, $1,807,255, decrease $78,495; net, $1,744,179, decrease $194,317; surplus after charges, $1,571,434, decrease $276,850.

NORTHERN STATES POWER CO.

For the year ended Dec. 31:

	1918.	1917.
Gross earnings	$8,392,664	$7,154,508
Net earnings	3,542,974	3,389,780
Fixed charges	1,922,714	1,709,837
Balance	1,620,260	1,679,943
Preferred dividends	1,036,915	916,611
Bal. avail. for amort. depr. and com. divs.	583,345	763,932

GENERAL GAS & ELECTRIC CO.

(Subsidiaries.)

Preliminary statement of gross revenue for the month of May, 1919, and 1918:

System.	1919.	1918.
Rutland	$ 43,014.39	$ 38,542.05
Northwestern Ohio.	30,100.00	27,092.76
Sandusky	42,003.74	32,426.30
Binghamton	37,163.96	34,263.06
Sayre	10,290.00	9,909.97
New Jersey	24,617.06	24,111.09
Interurban Gas Co.	720.25	842.26
Total	$187,909.40	$167,188.09

NEW JERSEY POWER & LIGHT CO.

12 months ended April 30, 1919—

Gross revenue (includes other income)	$332,043.14
Operating expenses and taxes	214,679.31
Gross income	$117,363.83
Bond and note interest, rentals and miscellaneous charges	79,372.34
Net income	$ 37,991.49

AURORA, ELGIN & CHICAGO.

Comparative statement of earnings for the month of April shows:

	1919.	1918.
Total earnings	$192,791	$156,937
Operating expenses, taxes	149,976	138,884
Net earnings	42,815	18,053
Interest	38,402	35,893
Balance	4,413	*17,830
Res. depreciation and amor.	8,877	7,110
Deficit	8,463	24,949

*Deficit.

UNITED LIGHT & RAILWAYS.

The statement of the company and subsidiaries for the 12 months' period ended April 30 shows:

	1919.	1918.
Gross earnings	$9,659,547	$8,232,903
Net after taxes	2,858,574	2,729,802
Balance	1,955,486	1,836,610
Balance after interest charges	*116,730	1,101,378
Surplus after pfd. div.	599,658	494,449

*Interest on notes and commercial loans purchased was $132,258, a decrease of $29,447 during this period.

STANDARD GAS & ELECTRIC.

Combined report of Standard Gas & Electric Co. subsidiaries for the first four months of 1919 shows an increase of 20.69 per cent in gross earnings over the first four months of 1918. Net for the same period shows an increase of 15.43 per cent. Comparative figures are as follows:

	April 30, 1919.	April 30, 1918.
Gross earnings	$9,530.452	$7,896,411
Net earnings	3,643,290	3,156,033

These earnings are without taking into account earnings from the newly acquired oil properties of the Shaffer Oil & Refining Company.